The Electrical World.

VOL. XXVII. NEW YORK, JUNE 20, 1896. No. 25.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,
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THE ELECTRICAL WORLD,

253 Broadway, New York.

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LORD KELVIN.

The jubilee given this week in honor of Lord Kelvin marked an ever memorable ending to his 50 years tenure of the chair of Natural Philosophy in the University of Glasgow, and a lasting commemoration to one whose name is revered by all Englishmen, and honored by all who know of his achievements. The number and importance of his scientific investigations and inventions make his long and most successful career unexcelled, and as all who love science have the highest admiration for those who have taken a prominent part in its advancement, so the name of Kelvin will be handed down with others most illustrious in the past to those who, in turn, admire his genius. It is seldom that the works of a man are so fully appreciated during his lifetime and it is with gratification that all who know his name extend at this time their congratulations, and most sincerely hope that many years more are before him during which he may still further advance those branches of theory and its applications for which he has already done so much.

ELECTRIC SHOCKS.

Recent instances of electric shock have occurred with fatal results, bringing forcibly to mind some of the suggestions which have appeared in our columns in regard to resuscitation in such cases. As many readers will recall, definite rules were printed in THE ELECTRICAL WORLD of Sept. 8, 1894, giving explicit directions how to proceed in case of suspended animation due to electric shock. It is the duty of all managers in whose stations high-tension apparatus is employed to carefully see that the linemen and station employees are instructed in the mode of treatment to be followed, and in order that they may fully comprehend its importance, to have them actually practice the requisite manipulations. Such methods, although they at the time appear trifling and unimportant, may find their application at any moment, and under the most unlooked-for circumstances; then it is that no time can be lost in looking up rules probably stowed in some out of the way corner, but a sufficient knowledge should be had on the part of those in attendance to understand the actual necessities and to immediately proceed to resuscitate the patient. It is not only gross negligence, but a sacrifice of human life to allow one suffering from electric shock to die without any attempt being made for his resuscitation.

MECHANICAL FLIGHT.

We print elsewhere in this issue an interesting article by Mr. Mott on mechanical flight, in which apparatus is proposed especially adapted to raising self-recording instruments to high altitudes for the purposes of obtaining weather indications. Judging by the success attained recently by Prof. Langley, there remains but one obstacle in the way of preventing the successful solution of a problem which has for years engaged the attention of scientists, and this is the want of a light and successful motor carrying its source of power upon the apparatus itself. To overcome this difficulty at present, light conductors may be used leading to the ground. It would then be possible by simply shifting the centre of buoyancy of the machine to maintain it in any desired position. The principle has now become well recognized that in order to have stability, weight is a necessary condition and that this, within reasonable limits, is an advantage rather than a disadvantage. On this basis it

would seem that the successful flying machine will not depend upon the use of inflated balloons, but upon simple mechanical movements run at high speeds and so designed that the supporting parts are continually being brought into quiet air. Looked at from this standpoint mechanical flight is no longer an unsolved problem, but one depending simply on the requisite motor.

HOT BEARINGS.

In small central stations, particularly where one or more jack shafts are employed, overheating of the bearings becomes a serious matter, often resulting in the necessity of shutting down the portion of the plant directly affected. Most engineers prefer to ruin their machinery, if by so doing a shut down can be avoided. The common practice in cases where the bearings become hot is to freely apply water, and, if possible, ice, and at the same time sufficiently lubricate to reduce the friction. The use of water on dynamo bearings is, however, a dangerous proceeding, owing to the liability of injuring the armature. Ice, while more easily handled, is not always obtainable, and is likely to produce the same harmful results. The continuous use of water on bearings is never desirable although sometimes necessary, as in the case of marine engines. It is owing, however, to occasional necessity that precautionary measures should be adopted and provision made for its use. This can be done by so casting the bearing shells that numerous passages, broad and flat in cross-section, would surround the journal. The entrance to these passages could be fitted with appropriate threaded nipples which would permit of the ready attachment of an ordinary hose, and thus water could be rapidly forced through when the bearing heats seriously. The same device is now successfully used on friction brakes where far more heat is developed than in the ordinary bearing, even one of the largest size, and yet the rubbing surfaces of the brake are kept so cool that they may be made of wood and at the same time be very durable. Such construction would not greatly increase the cost of a bearing and yet would reduce to a minimum the chances of overheating.

SUPERHEATING STEAM.

Of the many methods which present themselves for increasing the efficiency of the steam engine, none offers greater possibilities than that of superheating. The difficulties to be overcome in the superheating apparatus and the lubrication of the engine cylinder have, however, proved almost insurmountable, and it is on account of these two causes that so little progress has been made in this direction, although quite fully recognized as desirable some 40 years ago. Superheating offers the greatest possibilities not on account of the increased range of available adiabatic expansion or so much from the increase of thermo-dynamic efficiency, as from the reduction, or, in fact, entire elimination of initial condensation. It is to prevent this that jacketing has always been employed. Saturated steam naturally condenses very readily, while superheated steam which attains more nearly the properties of a perfect gas, reluctantly transfers its heat to surrounding surfaces. Owing to this physical quality, its use naturally results in more perfectly conforming to the Carnot cycle. The advantages to be obtained from its use are that the expansion may be carried throughout the entire cycle without condensation, the weight of steam used for a given amount of work becomes less, and consequently the size of the condenser, the volume of condensing water, and in fact the whole condenser system is materially decreased. This naturally has the apparent effect of increasing the efficiency of the boilers by increasing the heating surface and by eliminating the waste due to wet steam. In some tests made by Prof. Schroeter on a 1500-hp triple-expansion engine, employing steam jackets, the water amounted to 12.1 pounds per indicated horse-power with superheated steam, and 13.4 pounds with saturated steam, a net gain of 10 per cent. This was under conditions of a 1200-hp load. The test of the Schmidt system on an engine indicating 75 horse-power, the temperature of the steam admitted to the engine being 675 degrees Fahr., showed a consumption of steam of 10.2 pounds, and of coal 1.28 pounds per indicated horse-power, figures which show perhaps the lowest steam consumption on record. Prof. Thurston, in a paper recently presented before the American Society of Mechanical Engineers, concludes that superheated steam has absolutely no thermo-dynamic value, and therefore does not alter the ideal efficiency as expressed in the second law of thermo-dynamics but that superheating is superior to any other means for the reduction of internal waste, and no trouble need now be found with the engine employing sufficient superheating, under the usual conditions of operation, in annihilating cylinder condensation. It is in the construction of the boiler permitting of the use of a successful superheater that the chief difficulty still remains and in the overcoming of which no greater problem presents itself to the engineer. The final solution puts the steam engine on an equal footing with the best results likely to be attained in the gas engine.

Opening of the Chicago "L."

The Lake Street Elevated Railway, the second to be operated exclusively by electricity, was opened early Sunday morning.

The road runs west from the vicinity of the Masonic Temple, some 6½ miles, in double track. The electrical current is for the present taken from the stations of the North Street Chicago Railway Company. The current is carried upon a third rail just outside the guard timbers. This rail is supported by pillar insulators set every six feet, and is protected by two planks set on edge. This provision is made to prevent accident from carelessness.

The motor cars are the rebuilt cars formerly used with locomotives on the Lake Street Elevated. Each train will consist of three or four ordinary cars, with a motor car at the head. The motorman's cab is at the front right-hand corner of each motor car, and contains the controller, an automatic circuit-breaker, the air brake levers, and an electrically driven pump for the compressed air, which starts automatically when the pressure in the tanks runs down.

The electrical equipment of each car is the same as that on the motor cars of the Nantasket Beach branch of the New York, New Haven & Hartford Railroad and the West Side Elevated Railroad of Chicago.

Northwestern Electrical Association.

The fourth semi-annual convention of the Northwestern Electrical Association will be held at Marinette, Wis., commencing at 9 a. m. on Wednesday, July 15 next. Papers on "Insurance" "Incandescent Lamps," "Rights of Electrical Companies," "Lightning Arresters," "Alternating-Current Motors," "Storage Batteries," "The New York Convention and Exposition" and other subjects will be presented and discussed. The Western Passenger Association has granted a fare and a third from all points in its territory and return. Special through cars will be attached to the train leaving Chicago, at 3 p. m. on Tuesday, July 14. Those expecting to be present are requested to notify the secretary, Thos. R. Mercein, 303 Montgomery Building, Milwaukee, Wis.

Canadian Electrical Association.

The sixth annual convention of the Canadian Electrical Association is being held on June 17, 18, and 19 of this week at Toronto. Among the papers to be presented are "Ocean Cables," "Acetylene Gas," "Meters," "Consideration and Discussion of the Government Electric Light Inspection Act," "Some Central Station Economies," "Power Transmission by Polyphase E. M. Fs.," "Operating Engines Without a Natural Supply of Condensing Water," and "The Outlook for the Electric Railway."

Death of Mr. H. J. Smith.

Just as THE ELECTRICAL WORLD is going to press the news is received of the death of Mr. Harrison J. Smith, who was general superintendent of the Edison Electric Illuminating Company, New York. A few particulars of the accident which befell Mr. Smith are given in the column of New York notes in this issue. Mr. Smith's untimely death comes to many as a personal loss, as he was highly esteemed by all who knew him. He died on Tuesday morning, the fatal injury having been received on Sunday last.

The Kelvin Jubilee.

(Special Cablegram to THE ELECTRICAL WORLD.)

GLASGOW, June 16, 1896.

The Kelvin Jubilee began Monday, June 15, under most auspicious conditions. The weather was magnificent, and the arrangements for the interesting event were excellent. On Monday evening a conversazione was held in Bute Hall, in the University Building, at which 2500 persons were present. Telegraphic congratulations were received from all parts of the world, one of 100 words from Valparaiso, Chili, being transmitted in fifteen minutes.

On Tuesday morning Lord Kelvin was presented with congratulatory addresses from universities in England, America, France and other countries, by the special representatives of the same.

The University of Glasgow conferred honorary degrees upon Profs. Simon Newcomb, Cleveland Abbe, Mascart and Lippman.

On Tuesday night the municipal banquet will be held, at which 600 distinguished persons are expected to be present.

The greatest local interest prevails in consequence of this unique scientific gathering.

At New York the Commercial Cable Company, through its president, Mr. John W. Mackay, extended a special invitation to several persons prominent in the electrical science, and to a few of the electrical papers, to attend the pleasant ceremony of exchanging greetings with Lord Kelvin, on Monday afternoon, over a special circuit arranged for the occasion.

Among those who responded were Mr. Nikola Tesla, Mr. Frank J. Sprague, Dr. Charles E. Emery, Mr. George A. Hamilton, Prof. Edwin J. Houston, Mr. John Bottomley, Mr. H. Bottomley, and the representatives of several electrical papers.

Of the various messages which were sent and received, only the following from Lord Kelvin was given out for publication:

To the Editor of The Electrical World:

I thank you warmly, and through you the electricians of the American Continent, for the most kind message of congratulation which you sent me in their name. KELVIN.

The telegraph circuit established by means of the Commercial Cable Company's system extended directly to the hall at Glasgow while the exercises were taking place.

A cable dispatch sent by Lord Kelvin, thanking those who had congratulated him, was sent around the world and returned to the university in four minutes.

Among those present who congratulated Lord Kelvin were Profs. Ames, of Johns Hopkins University, Balitimore, Md.; Cushney, of the University of Michigan; Van Amringe, of New York, and Donald Smith, of McGill University, Montreal.

Röntgen Ray Experiments.

The results of experiments on Röntgen rays are apparently limited in number and more or less unimportant in indicating that this field of investigation has become either considerably narrowed in its scope or investigators are relaxing their efforts in producing new facts. In an article which appears in a recent number of the London *Electrician*, Prof. Lodge states that he was unable to find that Röntgen rays, when passed through an electrified plate could be deflected by a magnet, a condition previously reported by a French investigator. He says in this connection that this result is profoundly important if true, inasmuch as it would tend to strengthen the flying particle theory. Experiments on magnetic deflection are liable to disturbance owing to the action of a powerful magnet in displacing the cathode rays in even a distant bulb, and so changing the position of the source.

He therefore made experiments by attempting to twist the Röntgen rays traveling along the lines of magnetic force. If a Crookes tube, say the well-known one which casts a shadow of a cross on the glass end, be encased in a helix conveying a current, the shadow of the cross will be notably twisted, and the twist will reverse with the direction of magnetization. In other words, cathode rays travel spirally along a magnetic field. It was his experience that Röntgen rays do not; not even when passed through a highly electrified plate first, as in M. Lafay's experiment.

The magnet used was a Faraday magnet with perforated pole-pieces 5.6 cm apart, giving a field, at the middle, of 5600 C. G. S. lines per square centimetre, when excited for use by 15 or 20 storage cells. At the centre of this field was placed a hemisphere of aluminum with its edges thoroughly protected by an incrustation of molten paraffin, and this was electrified so as to be on the verge of sparking from its convex surface toward one of the poles.

The vacuum tube was placed so as to send rays through the tunnel in the first pole-piece, then through the aluminum hemisphere and out at its charged convexity, thence through the 2.8 cm of air magnetized to 5600 C. G. S., then half-way through the second tunnel, where they encountered a disc of sensitive plate, and impressed themselves upon it.

On the inside of the hemisphere were fixed a couple of parallel copper wires, which the rays encountered before entering the electric field, thereby throwing a shadow of them on the plate. A third wire, parallel to the other two, was fixed in the tunnel (out of either field) close to the plate itself, and when everything was right, on developing the plate, the three shadows came out sharply as three clear parallel lines close together.

The experiment consisted in noting micrometrically whether this parallelism of the shadows was preserved in successive experiments with the electrification or the magnetization reversed. Not the slightest angular twist of the pair of wires with respect to the single one could ever be seen.

The potential to which the aluminum surface was kept charged was about 40,000 volts, but it is not really a matter of volts, it is a matter of electric density, and this is best specified by saying that it was nearly, not quite, as high as air can stand. It could not be quite as high without risk of the hemisphere giving off an actual spark, which might damage the sensitive plate. Sparks to the pole-piece were obtained *before* inserting the plate, and then the potential was slightly reduced by the aid of a safety spark-gap elsewhere. This, which was 2.3 cm wide, was kept sparking during an experiment.

But although the result was thus negative in an electrical field in *air*, it was possible that there might be a possible result in some other medium,—an experiment akin to that of the Faraday magnetic rotation. Accordingly a thick glass plate, 7.3 mm thick, was coated on each side with a small patch of aluminum foil heavily coated all over with slabs of molten paraffin, and the pair of foils were kept electrified. The difference of potential that could thus be maintained across this thickness of glass was much higher than was possible with air, being maintained by a machine which was constantly giving a spark 7.5 cm long between its knobs (2.34 cm diameter), or over 100,000 volts.

This sort of Leyden jar was then placed in the same magnetic field as before, so that the electric and the magnetic lines coincided, and the three shadow-throwing parallel wires were again adjusted, two on one side of the glass, and a third between them, on the other side. The Röntgen rays were now passed through the glass, along the electric and magnetic lines, so as to throw a shadow of the wires on to a sensitive plate (or sometimes on a fluorescent screen); but still no trace of twist could be detected.

Other experiments were made of similar general character with a greater thickness of air between oppositely charged curved plates, etc., but this record may serve. He concludes therefore, that until the details of a positive experiment are forthcoming it is apparently not feasible to electrify Röntgen rays by passing them through an electrified surface, whether that surface have a plus or a minus electric density, and whether the medium entered be air or glass.

Rapid Transit in New York.

The Rapid Transit Commission held a meeting on the afternoon of June 11 to receive the formal application of the Manhattan Elevated Railway Company for permission to build extensions and add other lines to the present routes. Lawyer Julien T. Davies presented the application. The rooms were crowded with representative men from the north side of the city, also delegations of the North Side Association and Tax Payers' Alliance. These citizens opposed the granting of the application on the ground that the provisions were not adequate for that section of the city. Mayor Strong also objected to the application and stated that he would not vote for the proposition as presented. It did not agree with the assurances given by Messrs. George J. Gould and Russell Sage. No action was taken upon the application, and the subject will come up before the next meeting of the commission which will be held next Thursday.

Transporting Calcium Carbide.

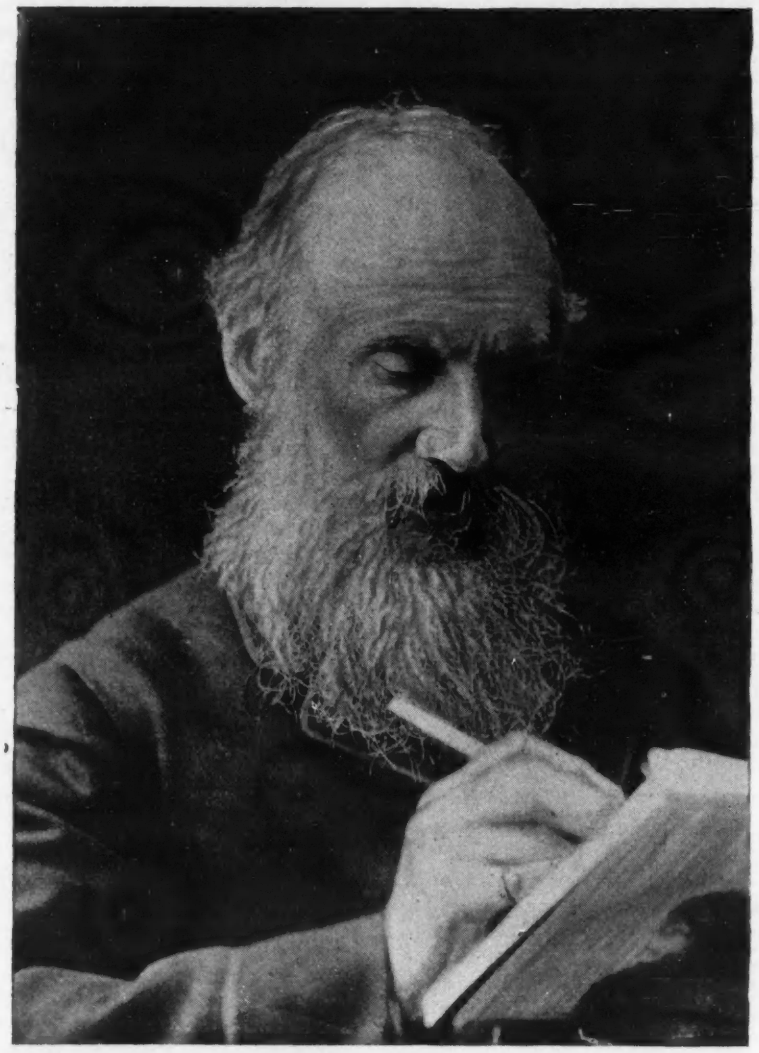
The *Electrotechnische Blätter* is authority for the statement that the Swiss Federal Council has decided that calcium carbide will only be received for transportation on railways when packed in hermetically-sealed iron cases. No other substances are to be packed with the carbide.

Lord Kelvin.

No single individual in all Europe will receive more attention and respect during the present week than he whose portrait accompanies this sketch. The name, Lord Kelvin, will pass down to posterity as holding a place in common with only the greatest masters in science. No living physicist has accomplished so much and added so greatly to scientific advancement than he. There is scarcely a field in which he has not worked, and then only with thoroughness and exactness.

He is not only a remarkable experimentalist, bringing a vast knowledge of all departments of science to the aid of his mechanical skill when engaged in some new research, but it is still to his mathematical genius and ability of practically applying his theory that his success as a physicist is so pronounced.

William Thomson was born at Belfast, Ireland, in June, 1824. His family, however, was of Scotch descent, and his father, Dr. James Thomson, who was a man of great mathematical talents, was educated at the University of Glasgow, his father taking the chair of Mathematics in the University. Four years later William commenced his studies in this institution. From here he went to St. Peter's College at Cambridge, and was graduated the second wrangler in 1845, at the age of 21. During his college course he was a great enthusiast in athletics and music, and was one of the best oarsmen of his time. On his graduation he was elected a fellow of St. Peter's College, and then entered upon a career which has made his name famous. At the age of 17 he communicated a paper to the *Mathemathical Journal* on the relation between the motion of heat in homogeneous solids and the mathematical theory of electricity, pointing out the analogy between the flow of heat and the flow of current, and showing how the same treatment could be applied to both subjects.



Lord Kelvin.

In 1845 his attention was drawn more particularly to electrical theories, and resulted in the production of a paper on the elementary laws of static electricity, a paper which attracted instant attention, and brought his name prominently before scientific investigators. From this time his mathematical and physical papers were numerous, and occupy at the present time three large volumes, besides others devoted to electricity and magnetism and popular lectures.

At the early age of 22 he was elected Professor of Natural Philosophy in the University of Glasgow, a chair which he has continually filled for 50 years, and which the present celebration commemorates.

Soon after 1846 his attention was drawn to the subject of dynamical theory of heat, which appeared in a paper communicated to the Royal Society of Edinburgh in 1849. He was quick to perceive the vast importance of Joule's experiments, and continued in company with him a long series of investigations. His first paper on thermo-dynamics was a critical review of Carnot's great work, and soon his course of investigations led him into thermo-electricity, resulting in the publication in 1855 of a splendid paper on the Electro-Dynamic Qualities of Metals, which was made the Bakerian lecture of that year. Through his undaunted efforts and the aid of his students the first physical laboratory was established in the University of Glasgow. About 1855 there came up the greatest problem in electricity which had thus far presented itself, that of successfully transmitting messages across the Atlantic. Following upon the work of Faraday, Thomson mathematically investigated the retardation of the electric current in conductors having distributive capacity and self-induction, and predicted results then considered to be entirely erroneous. Tests on the cable completed in 1858, however, confirmed only too conclusively the predictions he had made, and he was finally called upon to overcome the difficulties. It is to him that the final success is to be credited and it was for this that expression of admiration for his work was acknowledged by bestowing upon him the honor of knighthood. The outcome of his investigations was the mirror galvanometer, which was successfully applied. This was the first of the notable series of inventions which he has produced. In 1867 he invented the siphon recorder which later came into general use.

The first trials of the mirror galvanometer was made early in 1858 and it is somewhat curious to note that it was made by James White of Glasgow, whose name is now so familiar as the maker of Thomson's apparatus.

His patents are of many kinds, and so numerous are they that a large workshop in Glasgow under able scientific management is chiefly occupied in their production. His attention has of late years been confined to electrical problems, and besides investigating various theoretical topics he has produced a series of exact measuring instruments now used over the entire world.

His investigations on deep-sea soundings were conducted shortly after 1872, resulting in important improvements. These investigations, together with material changes in the mariner's compass, were of the greatest practical importance, and have been continually in use since 1876.

He visited America in the same year, 1876, and served as one of the judges at the Centennial Exposition. He again came to this country in 1884 to deliver a course of lectures on "Molecular Dynamics," at Johns Hopkins University. These lectures treated mainly the dynamical theory of light, in which he was then a firm believer.

He was elected to the peerage in the latter part of 1891. A list of Lord Kelvin's honors may form some indication of his world-wide reputation. He is LL.D. of the Universities of Edinburgh, Cambridge, Dublin, Montreal and Bologna; Dc.L. of Oxford, M.D. of Heidelberg, F.R.S., P.R.S.E., Foreign Associate of the French Academy of Science, Grand Officer of the French Legion of Honor, Commander of the Belgian Order of Leopold, and Knight of the German Order "Pour le Mérité." He was re-elected in 1872 a Fellow of St. Peter's College, Cambridge, and is now for the third time president of the Royal Society of Edinburgh. He was from 1890 to 1895 president of the Royal Society of London.

He has always been a keen yachtsman, and has employed the services of the *Lalla Rookh*, both for pleasure and research.

Personally he is a man of retiring disposition and is of a pleasing, gentle and winning nature, but most decisive in his utterances. He is far removed from being a grim professor, and it is always considered a great treat to hear him lecture or speak before a learned body. His conversational tone is low, but clear and pleasantly Scotch in its accents, and a smile plays over his face as he delivers some difficult scientific truth. He talks very quickly during his demonstrations,

as though there was not time enough for him to say all he had to say. He is not rhetorical, does not talk for effect, and it is soon evident to the listener that he is a perfect master of his facts. What he knows he knows thoroughly, and he has a faculty of presenting news in a way which the attentive mind will not soon forget.

About 30 years ago Lord Kelvin met with a serious accident while indulging in his favorite Scottish game of curling which has left him permanently lame, but notwithstanding his lameness he is a brisk walker. Despite his weakness, he throws all his energy into his work, and looks upon rapid journeys to London and back as pleasure.

One who addresses him is immediately charmed with his simple natural courtesy and by his kindliness. He has the power of distracting his thoughts from all surroundings, a power which he puts to good use by noting on all occasions in note-books ideas which may come to him. He can write at all times, and will do so not only on the train, but even in the drawing room, yet if disturbed he displays no irritation. It is seldom that we meet one who is less self-conscious, absolutely without affectation or any thought of self-importance. He converses in a manner so respectful that the person addressed is likely to imagine himself not only interesting but even informing to Lord Kelvin. However, things arise which awaken his spirit. One of these is politics, especially the subject of home rule. Spiritualism is another, for which he has an extreme contempt, yet no one is more reverent as regards all religious questions. He is neither an agnostic nor a materialist. Lord Kelvin has spent practically his whole life in the University of Glasgow, and his love for his *alma mater* is, of course, very great.

Lord Kelvin has been twice married. His first wife was Miss Crum, of Thornliebank, who was always considered a most charming woman, and her early death was a great blow to his affectionate heart. The present Lady Kelvin, formerly Miss Blandy, is one who seems to have been made for him; strong both in mind and heart, sympathetic and with a most engaging kindness.

Lord Kelvin commands not only the admiration of the scientific world but the affection of all who have come in contact with him, and Americans rejoice in extending to him their congratulations and hopes that his long life and magnificent work may for many years be continued.

Electro-Aerostatics.—I.

PROPOSED METEOROLOGICAL MACHINES—RAISING SELF-REGISTERING INSTRUMENTS INTO THE HIGHER ATMOSPHERE BY ORTHOGONAL FLIGHT.

BY S. D. MOTT.

In the last two decades the practical applications of the science of meteorology has made rapid strides, especially in the art of weather predictions and the forecasting of probabilities. At the present day this art is as accurate as can reasonably be expected considering present limitations and restricted working conditions; the daily weather probabilities issued by the Government are tolerably reliable enough so to be attentively observed by the social and commercial world and used to their comfort and advantage.

It is the opinion of many meteorologists, however, based on theory, no doubt, that but for the lack of certain physical appliances the art could be much improved and advanced to a yet stronger position. Ways and means are sought for taking high altitude readings. Some professionals go so far in their opinion as to assert that readings and observations in the upper air are proportionately more valuable, a hundred to one, than surface indications, and that if these ends could be accomplished and systematically established as an adjunct of the present system, weather forecasting would approach much nearer the status of an exact science through the workings of which many lives and much valuable property would be annually saved. If the opinion of these scientists go for anything and their assumption is correct, the solution of the problem is not only scientifically interesting but *commercially* important.

Science has furnished ingenious and wonderful solutions to many complex problems. It would seem at first glance that it should give a solution to this problem without recourse to any form of device or mechanism for raising self-registering instruments. Such is not the case apparently. In Europe every form of balloon has had a siege of trials, and in this country tailless kites, run tandem on a silk string made specially for the purpose, have been used and are being experimented with, I believe, at the present time. Up to the present, however, it must be acknowledged that these means have not succeeded in fulfilling the preliminary requirements of directness and safety, but have shown, and in the former case, in my opinion, always will show, their unreliability for the purpose in hand.

The writer is not a meteorologist, nor the son of a meteorologist, and will therefore tread lightly in that department of physics. A statement, however, as he conceives it, of the information sought in the upper air and cloud strata is, (1) the direction and velocity of the wind, (2) the temperature, (3) the barometric pressure, (4) the humidity readings; in short, a weather map at from 1000 to 25,000 or 30,000 feet elevation above an approximately fixed point at the variously established signal stations.

The design of the recording instruments to accomplish this is a problem for the meteorologist which I believe has been solved, their total weight not exceeding 10 pounds, but the ways and means of carrying from surface stations to various and predetermined altitudes the instruments which will be returned to the starting point, without injury, is quite another problem, which I will endeavor to show may be accomplished by means entirely mechanical.

I know of no experiments or trials having been made in this field by methods of orthogonal flight—which is defined by the French as flight into the air by direct downward dynamic thrust—which *per se* necessitates the conception of a flying machine.

The aerodrome or "air runner" illustrated in the drawings has this principle of action combined with the screw principle, *i. e.*, the aeroplane and the continuous thrust of the screw propeller are combined in close mechanical imitation of wing flight and assembled in such a way as to give the structural strength to apply the *speed* to obtain a fulcrum upon the air.

I look upon this problem of man-flight as a matter of speed of the moving elements, whatever apparatus were used. There is no physical reason why with sufficient speed the same power by thrust cannot be attained in air as is daily observed in the denser medium, water. This statement is made in precisely the same sense as the

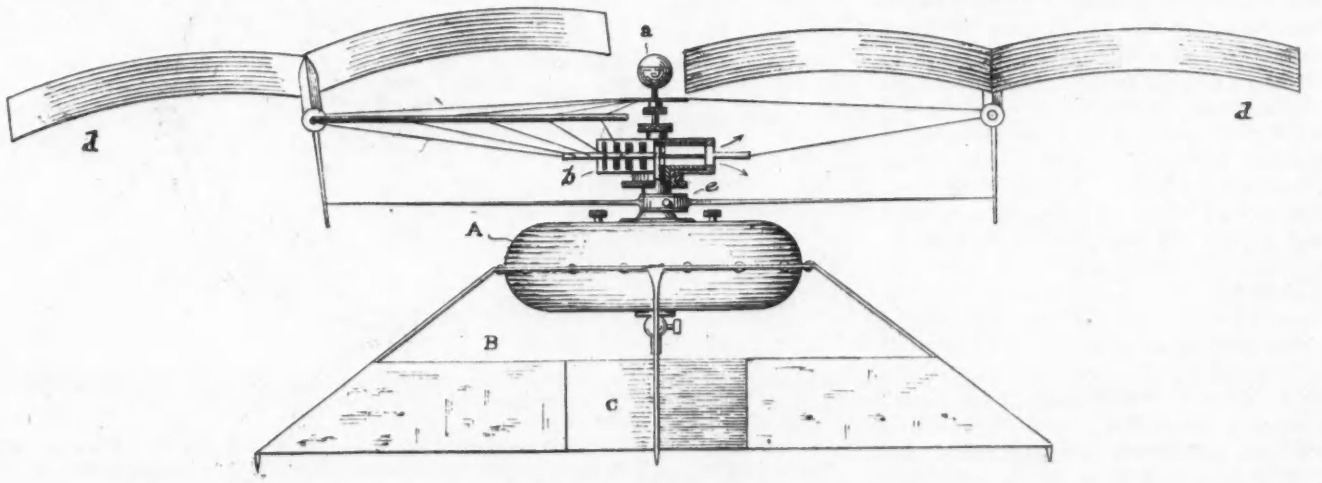


FIG. 1.—ELEVATION.

By scale and plan of Fig. 3 and experimentally established data, this machine will raise theoretically 1155 pounds at 375 r. p. m. By scale and plan of Fig. 2 and 375 r. p. m. it will raise theoretically 514 pounds.

statement of the fact that the screw of an ocean steamer must make more revolutions per minute in fresh water to give the same forward impetus to the vessel than it does in salt water because of the difference in the degree of density of the two media.

A driving wheel of the cycle tangent-spoke pattern is the structural base of this machine. Its major strains are tensile and cushioned by air resistance only while in motion, and there is no heavy rubber tire; the rim would preferably be made of aluminum tubing or wood, and the spokes of needle or piano wire, after the manner of

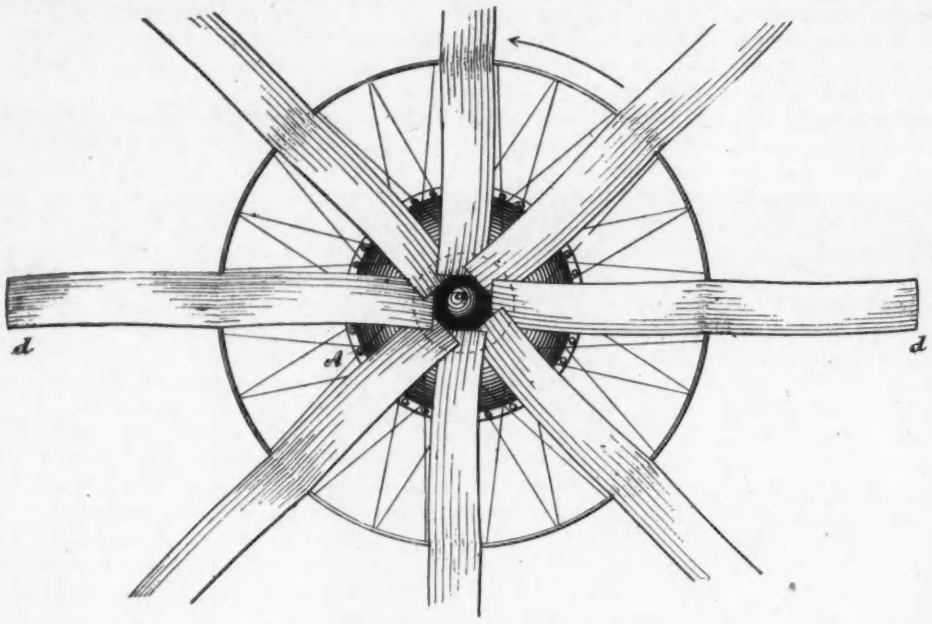


FIG. 2.—PLAN VIEW OF AEROPLANES OSCILLATING IN THE PLANE OF THE PAPER AND REVOLVING AROUND A COMMON CENTRE. *a*—LUBRICATING CUP. *A*—AIR RESERVOIR. *dd*—PLANES.

racing bicycles, though in fact much lighter; one of 5 feet in diameter having sufficient strength, could be made weighing between five and eight pounds. Arrayed around the circumference of this wheel are aeroplanes, set at an angle of an efficient screw duplicated to give multiplying effects, hinged at or about midway between their ends on ball bearings and allowed oscillation on these fulcrums by the eccentric *e*, Fig. 1, or crank action shown on the axial shaft, Fig. 4. It is clear that to oscillate the planes the axial shaft may be held stationary while the driving wheel is revolved, but preferably and with an important end in view, it would be revolved in the opposite direction, giving a dual motion of oscillation and translation to the planes.

Dual motion is an essential to the practical working of aerial propellers when poised in the air; it nullifies gyroscopic tendencies; it enables the acting and reacting force of any prime mover to be distributed and absorbed in the thrust or driving action. The force which drives the wheel reacts upon and counteracts the force which oscillates the planes, completely neutralizing the reaction of any motor when free from a fixed base. This very important feature can be made clear by the following simile. Picture, in the mind's eye, a screw propeller on a vertical spindle driven by any form of motor, for instance, a clock spring on the floor or ground. Under these conditions it is evident that the screw will revolve, and if it exert a sufficient thrust will rise with the motor in the air. What, then, is the result? The motor is suspended in the air, free from a fixed base, and offers no resistance to revolution, while the screw offers all the resistance to revolution, with clearly the result that the screw will stop, the motor will revolve, which conditions are the opposite of the starting conditions, with the inevitable result of a sudden descent and a repetition of the operation.

The action of the planes varies from the wing flight of birds in that they have an oscillating, instead of a flapping, motion, and the direction of thrust is downward and circular instead of downward and straight away. It also has another important feature, in common with the physical principles of the bird's wing, in that the up-and-down motion, because of the motion of translation, is always positive, and in no sense negative, giving continuous sustentation, and this, combined with the comparatively large plane surface and high speed, is depended upon to sustain the machine on the fulcrum presented by the air.

Fig. 1 is an aerodrome (showing only two planes, for clearness), operated by air, compressed to a high degree of tension in a steel reservoir, *A*, thence passing through a throttle to the atmospheric turbine, having two oppositely revolving parts instead of one, as this engine is usually constructed. Each of the parts (the acting and reacting) is closed mechanically with the dual motion of the aeroplanes through the medium of the driving wheel and eccentric. The engine exhausts into the atmosphere, as shown by the arrows, and is arranged to exhaust one part at a time, in rotation or all simultaneously; its detail is not shown; it has no valves or reciprocating parts, and has been made to develop, using steam, 20 horse-power in the space of six inches diameter.

Fig. 1, *a*, is an oil cup for lubrication, *b* is the turbine, *e*, the eccentric, showing two of the (four or more) connections with the planes *dd*, which determine their oscillation. Fig. 2 is a plan view of Fig. 1, showing it arranged with eight aeroplanes, which may be increased, even doubled in number.

Stability and equipoise are assured by the plane of buoyancy (displacement) being well above the centre of gravity. It is evident that this instrument, supplied with adequate power, will rise into the air until its ascensional force equals gravity, when it will stop and begin to descend, while the planes yet have motion to offset and render *nil* the law governing falling bodies. In case it were found by trial trips that the exhaust of the motive power did not land the apparatus with a sufficient absence of shock, a time throttle, working in conjunction with a barometic governor, may be adopted.

As the diameter is the determining factor in the formulas for calculating the rupturing point or elastic limit of spheres and cylinders, a minimum of size and consequent weight of reservoir, *A*, and a maximum of available air pressure is clearly indicated. Experiment would determine the size of reservoir and the tension of the air necessary to carry the machine to a predetermined altitude, and it might be found convenient to have it connected to the surface by a silk

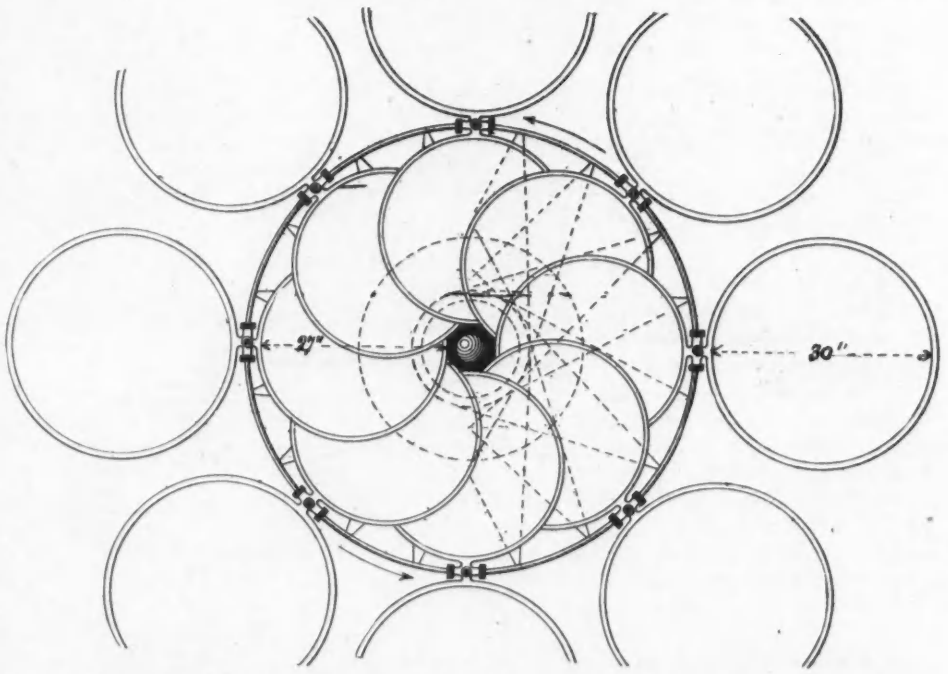


FIG. 3.—CANTED OSCILLATORY AEROPLANES OF CIRCULAR FORM HAVING FLEXIBLE CENTRES MOVING AROUND A COMMON CENTRE.—Diameter driver 5 feet; of plane 30 ins. or 27 ins.

string, which at any time would show the altitude and be at the same time a finder if for any reason the machine were lost; and I may add that such a connection may be made strong enough to force the machine back to the surface while it yet had considerable ascensional force.

It is evident that such an apparatus would return in still air to the point of starting approximately, and the heavier the device the more this feature may be relied upon; but to enable it to keep a vertical path in a wind of a steady or varying intensity, the simple expedient of a stationary rudder, *B*, is availed of to force the machine out of equilibrium by the wind, headed to the wind. For this purpose the fabric, *B*, Fig. 1, is crossed at right angles and fastened below the centre of gravity to the tripod support, which, when acted upon by variable air currents, will careen the machine to a proportionately varying angle to the wind, more or less antagonizing the tendency of its being blown from a vertical path; the stronger and more sudden the wind, the quicker it heads to it like a sailboat with a loose rudder.

I am aware that this reasoning is fallacious when applied to a body floating in the air, carried on the wind, but claim it to be good philosophy with heavy bodies self-impelled with power through the air. A boat floating with the tide is not influenced by the rudder, but when impelled transverse to the tide it will instantly respond to rudder influence. As an alternate construction, however, an automatic rudder can be applied to effect the same end.

The higher the speed and the heavier the machine the less it would be influenced from the vertical path by the wind at right angles to its medial line, while at the same time air in motion would increase its propelling efficiency. At *C* may be located a basket receptacle for self-registering instruments.

Fig. 2 shows a plan of planes of moderate surface for high velocities. They may be made of wood or shell aluminum, or celluloid films fixed to bowed spring steel, and their thrust may be increased by making the edges diverging like the ordinary screw propeller instead of parallel, as here shown.

In Fig. 3 the effective surface of the planes is increased by making them of thin steel rings having flexible centres of oiled silk, or its equivalent, which will in rapid motion present a concave under-surface to the air pressure. This construction would be as effective as Figs. 1 and 2 at a slower speed of revolution.

Fig. 4 illustrates an electrically operated aerodrome, the motor being of the multipolar type, the field magnet being integral with the wheel, and driving the same, while the reverse motion of the armature oscillates the planes by means of the crank on end of armature shaft and its connections. The charge given the battery may be made to determine the time or the height of flight approximately. The weight of a storage battery for this purpose would be about 35 pounds per horse-power one half hour, and the weight of the motor around 10 pounds per horse-power. It is recorded that Trouvé made an electric motor having wide tangential pull similar to that shown in Fig. 4, which weighed only seven pounds per horse-power.

The materials used in construction are aluminum, steel, wood and silk. Aluminum is used in parts not subject to tensile strains and for motor coils by which the magnets are energized; the aluminum wire being drawn and insulated in the usual manner. For iron in the motor may be substituted the lighter metal nickel (superimposed in coils) which ranges in susceptibility to magnetic excitation slightly below iron.

The batteries may be omitted and the machine driven to an exact altitude by currents transmitted from a high-tension dynamo on the surface through light flexible conductors, the length of conductor played out determining the height of flight. Such a machine has been devised to carry an observer.

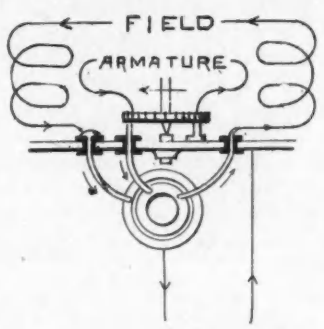


FIG. 5.

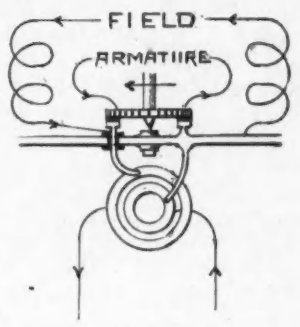


FIG. 6.

The adoption of an alternating current motor would simplify the working parts by doing away with the commutating arrangement shown in Fig. 5 and 6.

Machines of the character here described may have other uses than scientific investigations. They may be used for signaling visual intelligence to great distances by the Morse or marine code, using colored discs by day and colored lights by night; or electric flashes may be transmitted from the surface.

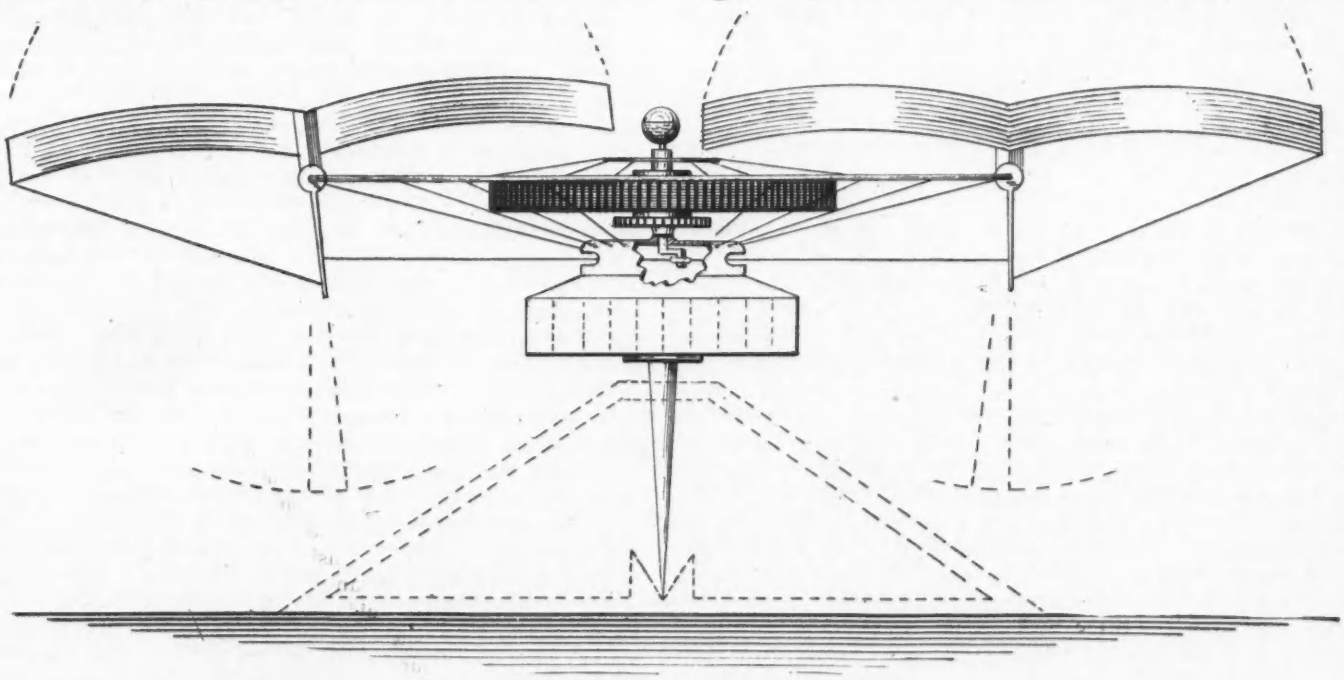


FIG. 4.—CIRCULAR WING ACTION.

One element of the motor (the field) moves the planes circularly, the other element (the armature) oscillates the planes on their fulcrum. One element of motor reacting against the other reaction is absorbed and neutralized when free from a fixed bare. Sweep over all 10 feet.

The London-Paris Telephone Line.

Four additional tolephone lines are to be laid between London and Paris, an agreement with this end in view having been arrived at between M. Boucher, the French Minister of Posts and Telegraphs and the British Postal authorities. The corporation of the Paris stockholders will advance the sum of $130,000 to cover the cost of the aerial lines in French territory and half the cost of the cable across the channel.

Central-Station Working—XVIII.

On the Use of High-Efficiency Lamps.

BY H. W. FRUND.

In the matter of economies in central-station practice, in the opinion of the writer the incandescent lamp subject is of paramount importance. It is not pleasant to the station manager to be continually reminded by his customer that his light is poor and his service bad, and as the question is a difficult one to deal with, he, as a general rule, shifts the blame to the lamp manufacturer, when in the majority of cases the trouble is with the manager himself, owing to a disregard of the existing conditions in his system. Not a great while ago, in the presence of an agent of one of the largest central stations, attention was called to the poor quality of light in general. In reply, among other causes, the transformer had to take the major share of the blame for the reddish light, on the plea that a transformer, after being in service a few years, would become inefficient and cause the candle-power to drop. Not having had this experience the question was argued and the actual cause found and remedied. One can just as well have nice white lights with less cost and expense if a little care is exercised.

In the first place, do not rely on central-station voltmeters particularly in reference to alternating systems, as there is not on the market to-day a first-class alternating-current station voltmeter, one independent of changes in the frequency of the current and temperature variations. No station is complete without a standard portable voltmeter, and I consider it as foolish to attempt to operate a plant without one as to start a vessel out to sea without a compass.

Not all portable voltmeters are without faults, however; and one should be selected which will compensate for the varying temperature of the atmosphere.

Before going into details as to how to keep lamps always bright so that the light will be well diffused, the central-station voltmeter must be first fully understood by the station attendant. As an illustration, consider a primary voltage circuit of 2000 volts. At the centre of distribution there is a line loss at full load with, say 1300 lamps, of 2 per cent.; the loss in the secondary circuit being practically the same and all lamps being wired so that the secondary voltage is 100, the speed of the alternator should be noted as well as a thermometer when taking the voltmeter reading. The reason the temperature must be taken into consideration, is that any dynamo attendant will notice, that with a sudden change and fall in temperature, at the same speed of dynamo, the lights are brighter, and if he will compare the station voltmeter again with a portable voltmeter, he will see that the station instrument is too high. The zero mark of the station instrument changes with the temperature, and for this reason the writer has always kept a card below the voltmeter showing the corrections above and below certain temperatures to be allowed, also corrections for change in frequency. It has been found good practice to compare the station instrument with a reliable portable instrument, fix a zero mark and change the needle of the station voltmeter, say at 80° Fahr., with the machine at full load and proper speed, and then compare frequently for errors.

If at full load the primary loss is 2 per cent. and the secondary is 2 per cent., you must compensate for this drop, which is practically 4 per cent., which would mean your station voltmeter would stand at 104 volts at full load.

As the load drops have a card on the station switchboard which will instruct and direct the attendant to drop the voltage at the station as the line drop becomes pronounced by the turning off of lights. It would astonish any one to note that there are times when the needle at the central station can indicate 100 volts and the lights will be as bright and cheerful as when at 104 volts at full load. There are several reasons for this; as stated before, with the change in the number of lamps, a change takes place at the central point of distribution, bringing the same in our case nearer to the station and dynamo; in fact, when not at full load there is a continual shifting of the central point. There is a gain in efficiency of transformers and wiring. As the load goes off the speed of the engine and dynamo is materially increased from full load to light load and there is also less slippage of belts. To check up this work, careful comparison should be made at times outside of the central station of the record of the voltmeter. There has come under our observation a case where the centre of distribution at full load was more than 6000 feet from the dynamo, and after midnight the load had so fallen off as to bring the centre of distribution near the dynamo. In cases of this kind, which are many, stated observations should be made at the extreme end, and if the above methods are carried out it will be found that the readings at light loads will be almost identical with the central-station readings, and in consequence the lamps all during this period from full to light load will have had the same voltage at their terminals, otherwise there would have been an increase from 6 to 10 volts, sufficient to make any lamp short lived and dull after a few nights' service. We are of the opinion that where this practice is carried out, troubles with the lamp manufacturers will cease and there will be no more use for 4-watt lamps, and special attention will not have to be paid to the manufacture of lamps for irregular voltages. We have in operation a plant in which the foregoing methods have been in use for the past four years, and we are using lamps having an efficiency of 2.6 watts. Naturally, with lamps of this efficiency, the dynamo attendant must exercise care and drop the voltages as the amperes in the primary lines drop. Instead of sending in requisitions to lamp manufacturers for, say, "five barrels of 20-cp, 100-volt, 3-watt lamps, T.-H. base, to compete with Welsbach sepulchre lights," he will instead order, "five barrels 16-cp 3-watt, 96-volt lamps, T.-H. base." Burning the 96-volt, 3-watt lamp at 100 volts will give 20.64 candle-power, the efficiency will be 2.56 watts per candle, and the life of the lamp will average 800 hours, which cuts no figure at their present price.

It must be understood, however, that lamps cannot be burned above normal voltage without good regulation, as stated, otherwise the shortening of the life of the lamp will be in proportion to the increase in voltage. Regarding the efficiency of lamps burned above normal voltage, it might be well to state, that a 16-cp, 3-watt, 96-volt lamp burned at 100 volts will give 20.64 candle-power and the efficiency will be 2.56 watts per candle. A 16-cp, 3-watt 98-volt lamp burned at 100 volts will give 18.11 candle-power and the efficiency will be 2.77 watts per candle. A 20-cp, 3-watt, 98-volt lamp burned at 100 volts will give 22.64 candle-power, and the efficiency will be 2.77 watts per candle.

A 20-cp, 3-watt, 98-volt lamp burned at 102 volts will give 25.65 candle-power and the efficiency will be 2.56 watts per candle.

A 16-cp, 3-watt, 100-volt lamp burned at 20 candle-power would require 103.7 volts, and the efficiency at 20 candle-power would be 2.61 watts per candle.

It should be borne in mind, that an average 800-hour 2.5-watt lamp cannot be expected where the wiring is irregular and improperly planned out. One point should always be kept in mind, particularly in alternating central-station work, and that is the wiring tables and formulas given thus far do not take into consideration the additional apparent resistance to alternating currents. The formula which we have used with the high efficient lamp referred to and for alternating current is as follows:

Multiply the total distance (in both directions) in feet of the wire which carries the whole current, by the total current, and this product by 13. This 13 represents the apparent ohms per mil-foot of wire. The ohms per mil-foot for direct currents we generally consider 10, but the loss on the large sizes of wire for alternating current is a trifle more, and we find that 13 is about right for wires above No. 8 B. & S. gauge. We never use this factor for smaller wires, for the reason that it is absolutely on the right side and wires will always be large enough. In actual practice, it is shown that the loss on alternating current is a trifle greater on the larger wire than it is on the smaller. Furthermore, regarding good wiring, which is essential to good lighting for secondary work, the best way in every case to figure loss is to put all the loss you can between your power or transformer, and your first lamp, for the reason that the variation in your lamps, if your loss is small from your first to your last lamp, will not make any difference in the candle-power of your lights; for example, suppose, instead of using a No. 12 wire, you would put a No. 14 B. & S. from your transformer to your house, main cut-out, or first lamp, your loss would be, say 1.5 per cent. instead of 1 per cent. Using a No. 12 B. & S. instead simply lessens the variation in candle-power of your lights for reasons one can readily understand. With a 2-per-cent. secondary loss this would make your outside wire No. 14, inside No. 12, making the drop 1.5 per cent. and one half of 1 per cent. respectively.

The formula we work from is as follows:

$$\frac{C \times L \times K}{V} = \text{circular mils area.}$$

C = Current in amperes.

L = Total length of wire contained in both legs of circuit.

K = Constant of 13, equivalent in inductive resistance to 1 mil-foot commercial copper.

V = Volts loss.

One of the advantages of the greater loss between transformer and first lamp, to avoid variation of lamps mentioned herein, is the expense of changing wires in business houses where the wires have been originally installed, say one-half of 1 per cent. loss. Should there be a number of additional lights placed in a room, where one-half of 1 per cent. loss was calculated, so as to make the total loss between transformer and centre of distribution 3 per cent. instead of 2 per cent., then, inasmuch as the outside wire being the smaller in the first instance, it can be more easily taken out and with less expense and a larger wire replaced, bringing the loss back to the original wiring of 2 per cent.

The question of wiring in reference to lamps on main feeders also plays an important part, and should be well worked out before purchasing wire for uncertain duty. Where already installed, the best way is to test with portable instruments at different parts of system, compensate where possible, and always change where variation in voltage is great, preventing good regulation, even candle-power, and good service.

The Mistakes that May Be Made in Consequence of the Prevailing Tendency to Reduce the Speed of Electrical Machinery.

BY WILLIAM BAXTER, JR.

Within the last two or three years the tendency to reduce the speed of electrical machinery has been growing so fast that it is desirable that the subject should be considered from various standpoints and the idea determined whether there is not such a thing as going too far in this direction. It is very important to know how long high-speed machinery will last or at least what is its relative life compared with the slow-speed types. If the life of the former is but a few years, the slow-speed is undoubtedly better; on the other hand, if the high-speed type will last for many years the case is quite different. Past experience seems to show that high speed in electrical machinery is not very destructive. There are very many high-speed dynamos in use to-day which have been in constant service for over 15 years, and are apparently in good condition. Many of these machines have solid bearings, but notwithstanding this, the original bushings are in many cases still in use. The commutators have worn out and some have been replaced several times, but since the introduction of carbon brushes, wear, in this respect, has been reduced to a minimum, and unless there is considerable sparking, the commutator should now last almost indefinitely. The speed of what are considered high-speed engines is very low when compared with that of dynamos connected directly to steam turbines, yet the wear on these machines does not appear to be serious. Owing to the fact that electrical machines have but one moving part, and that the motion of this is rotary, high speeds are not likely to produce serious results unless the moving part is not properly balanced, a condition, however, seldom or never met with in machines turned out by any first-class manufacturers. A speed of 700 revolutions per minute would not bring any undue strain on a 100-kw generator designed for a speed of 250 if direct connected. With this latter type of generator slow speed is desirable, in fact, necessary, on account of the limited speed of the engine. Engines of the size used for this purpose run at piston speeds ranging from 500 to 600 feet per minute, and the driving pulley is generally of a diameter about five times as great as the stroke. The belt velocity under such conditions is $5 \pi S \div 2$, S being the piston speed in feet per minute. Assuming a 100-kw generator to be driven by such an engine running at a piston velocity of 600 feet the belt speed would be 4710 feet per minute. This velocity would reduce the belt strain to about 1000 pounds which could be transmitted with a 14-inch double belt. The speed of the generator would be about 500 revolutions per minute with a three foot pulley and 600 by reducing the pulley to 30 inches. This would be a decided improvement on the results obtained with a speed say of 350 revolutions per minute, as the width of the belt would be reduced from 20 required for such a velocity to 14 inches and the cost of the generator would be considerably less. There can be no question but what direct-connection is the best for large units, say from 200 kilowatts up, for with machines of that size the belts required to transmit the energy are so large as to be troublesome as well as costly, but it is not by any means certain that any advantage can be shown by direct-connected units of half this capacity. Many are willing to pay for compactness and simplicity and such will use direct-connected generators whether they possess any other advantages or not. But many others look wholly to the economical side of the case and use that type of machine which will give the best results for the money invested. A direct-connected generator economizes space, saves the expense of belt renewals, offers less danger and is perhaps a more durable machine, but after all, compactness is the only real advantage so far as small and medium-sized machines are concerned. The operation of belt generators shows that in the matter of durability they are all that can be desired. The wear and tear is not great and it is very doubtful whether it will exceed 2 per cent. a year, including the renewal of belts, excluding the uncertain item of armature burn-outs, which is just as likely to occur with direct-connected as belt generators. If the ordinary repairs of belt machines can be made for an amount not to exceed 2 per cent., it seems evident that the direct-connected generator will not be able to show much gain in the cost of maintenance. In certain lines of work where the changes in load are frequent and very violent, the wear and tear on a direct-connected machine is much greater than on a belted one. This is especially the case in railway work, where it is not an uncommon thing for generators to become short-circuited. In the former, the elasticity of the belt relieves to a certain extent the sudden jar, but with the latter, as there is a rigid connection between the armature and the engine, the strain is transmitted instantly and sometimes with serious results. In the matter of efficiency the smaller sizes of direct-connected generators are not equal to the belted machines as the speed is so much reduced the efficiency must be sacrificed in order to keep the cost of production within reasonable limits. In many cases the space is limited and a direct-connected machine is the only kind that can be used. The speed of belted machines when driven from a belt shaft may be made anything desired. In such cases a speed should be adopted which will give belt velocities ranging from 4000 feet per minute for machines of 20 or 25 kilowatts to about 6000 feet per minute for units of 75 or 100 kilowatts. With these velocities the width and cost of belts can be kept within reasonable limits, and the wear will not be excessive, as will be demonstrated by actual experience. Generators belted directly to the driving engine must conform to the velocity of the latter, and the size of the driving wheel, and therefore will not be able to run in most cases as fast as if driven from a line shaft. The desire to reduce the speed has not been confined to generators, but has also affected motors, and it may be said with very beneficial results, as in most cases these machines were formerly run at velocities much higher than were advantageous. As motors are used to impart motion to other machinery their speed should conform to the requirements of the latter. Motors of small sizes, say from 1 to 4 or 5 horse-power generally operate high or moderately high speed machinery, and the shafting usually is run at velocities ranging from 250 to 350 revolutions per minute. As it is desirable to avoid the use of an intermediate shaft whenever possible, the speed of the motor should be low enough to belt direct to the line shaft. This can be accomplished in almost every case by adopting speeds ranging say from 1400 for one horse-power to 1200 for five horse-power. A 4-inch pulley on the 1-hp motor belted to a 16-inch pulley on the line shaft would be in good proportion, and would give the latter a velocity of 350 revolutions per minute. As the belt speed would be nearly 1500 feet per minute, a 1-inch belt would be more than ample to transmit the energy, and a 2-inch, which is the size that would probably be used, would run with an exceedingly light strain. The speed of the shafting does not as a rule drop below 200 revolutions per minute in the operation of the general run of machinery, even when the power used is as high as 100 or more horse-power, therefore it is not necessary to reduce the speed of motors above five horse-power much below 1000 revolutions. For example, a 10-hp motor running at 1000 revolutions per minute by a reduction of 5 to 1 would be belted direct to a line shaft running at 200. This reduction would be obtained by using an 8-inch pulley on the motor and a 40-inch pulley on the shaft. The belt speed would be 2000 feet per minute, therefore a 4- or 5-inch belt would transmit the power. A 30-hp motor running at a velocity of 900 would have to reduce in the ratio of 4½ to 1, giving the line shaft a speed of 200. This would be obtained by using a 14-inch pulley on the motor and 63-inch on the shaft. The belt speed would be about 3300 feet per minute, which would call for a 7- or 8-inch belt. The highest speed that can be used with motors if they are designed to belt direct to the line shaft without losing too large a pulley on the latter would be found to be very moderate and much under that at which they could be run without injurious results. Nevertheless it is much better to adopt this low speed. A higher velocity would

reduce the cost of the motor, and as a result the cost of the repairs thereon. But this gain could only be effected by using an intermediate shaft, and the cost of this would undoubtedly be greater than the saving in the price of the motor; furthermore there would be two belts to wear out instead of one. It is evident, therefore, that nothing could be saved by running the motor at a higher speed, and much would be lost in the way of simplicity and compactness. It may be said, however, that while it is desirable to use just as high a speed as the conditions will permit of, so as to reduce the first cost as well as the maintenance, it is not wise to use a speed so great that the motor cannot be belted directly to the line shaft, unless the case is one where the speed of shafting is so low as to render direct belting impracticable. Most of the prominent motor manufacturers are now making machines for three different speeds, that is, high, moderate and slow; consequently, a speed to meet the requirements of almost any case can be easily obtained, if the purchaser in making a selection is guided by good judgment.

The Storage Battery in Telegraph Work—II.

BY MAURICE BARNETT.

(*Continued from page 710.*)

Before passing from the question of the adaptability of storage batteries for telegraph work, a comparison may be instituted between storage batteries and dynamos when used for the same purposes. According to Mr. Finn, "the elaborate series of engines and dynamos now furnishing the electromotive power in many of our telegraph offices could, in the opinion of expert authorities, be replaced with accumulators with considerable economy in capital expenditure, and an ultimate saving in the cost of maintenance." Accumulators possess very decided advantages over dynamos for the following reasons: In the first place the battery system is very flexible. By connecting cells up properly any number of combinations may be effected governing the voltage and amperage of the battery in question. Again, from any set of cells connected in series different circuits may be operated under different voltages by simply tapping the battery at the proper points. Thus, at Atlanta, Ga., the Western Union Telegraph Company draws, from the same battery plant, current at 86, 172, 258 and 344 volts. Any battery, furthermore, may be broken up into units of any desirable size. With dynamos this is not possible without a corresponding loss. Dynamos are manufactured in units of a given size, and purchasers have to take the size offered. There is, therefore, no possibility of quickly establishing a new unit to meet new requirements. Dynamos, furthermore, are wound to run at a certain voltage. If, through any change of plans, the voltage needs to be reduced a certain waste is inevitable by reason of necessity of introducing resistance to diminish the potential differences on the circuits. It is rather awkward, too, to operate several lines, requiring different pressures, from the same

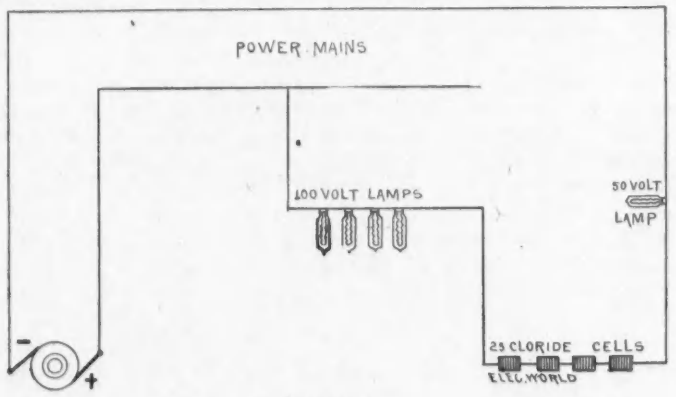


Fig. 2.

dynamo. Accumulators, moreover, being reservoirs of energy, can furnish current for a considerable time if the charging machine is disabled. With dynamos or motor-generators any trouble in the power plant will hang up the generators until the trouble is removed. If complete duplicate plant be maintained consisting of gas, gasoline or oil engine and dynamo, the first cost will be excessive, while the maintenance cost will be much larger than that of storage batteries. Again, with dynamos the voltage is not so constant as with storage batteries.

Having entered into some detail respecting the relative merits of primary batteries, dynamos and storage batteries for telegraph work, it may be pertinent to inquire what it is that determines the number and capacity of storage-battery cells required to perform a given work on local and main-line circuits. To determine for local circuit work the ampere-hour capacity a battery should have to operate a certain number of instruments for a certain number of hours, the following rule may be applied: *Multiply the number of instruments by the current required by each and the product by the number of hours the battery is to be worked on a single charge.* To ascertain the number of cells to be placed in series: *Multiply resistance of each instrument by current required to operate it and divide product by two.* In order, however, to provide against

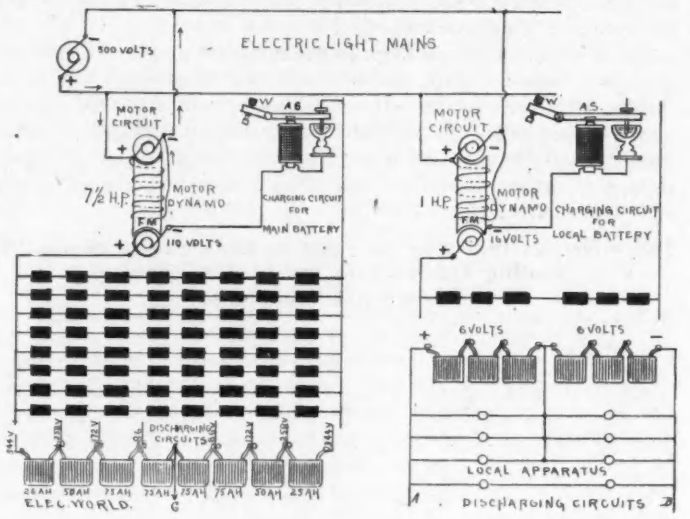


Fig. 3.

the variations which arise in daily work, it is customary to install a battery of somewhat larger capacity than is demanded by purely theoretical considerations. Thus, if in applying the above rule it is ascertained that if the theoretical requirements point to an 80-ampere-hour cell at 1.25 volts it is advisable to install a 100-ampere-hour cell. This would furnish current for 100 ampere-hours at two volts. For main-line work the rules governing the determination of number and capacity of cells required are practically the same as above. For capacity: *Multiply the number of lines by current required on each and the product by the number of hours battery is to be worked on one charge.* For number of cells in series: *Multiply current required on each line by resistance of such line and divide product by two.* As in the previous case, a sufficient margin will have to be allowed over and above the theoretical capacity for the reasons given. Thus if we were lead by theoretical considerations to use a battery of 180 cells of 7½-ampere-hour capacity each it would be expedient to install a battery of 180 cells of 10-ampere-hour capacity each. The above rules are based on the law of Ohm.

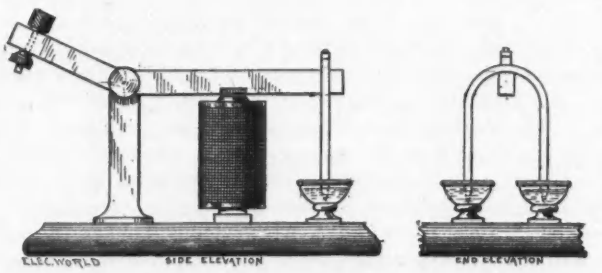


Fig. 4.

Before passing on to special installations a brief statement of the nature of the accessory apparatus used in conjunction with storage batteries will be in order. Depending on the conditions at each office, different apparatus will be required. Thus, if an alternating current is the only source of electric energy available for charging the batteries, a "rotary transformer" will be needed to transform this to a direct current of proper voltage; or, instead of a single machine, an alternating-current motor may be used to drive a direct-current dynamo, the result being the same in the two cases. If the charging current be direct, with pressure slightly in excess of what is required, a cheap and ready method

of reducing the pressure would be to introduce counter E. M. F. cells into the circuit. These cells consist of simple lead plates immersed in dilute sulphuric acid of specific gravity about 1.1[10]. When a current passes through such cells a counter pressure of two volts is developed by each of such cells in series. By means of a counter-cell switch one or more of these cells may be thrown into the circuit as desired.

It frequently happens, however, that the only available current is one to be derived from a light or power station with a voltage greatly in excess of that required for charging the battery. In such a case it would not be economical from the point of view of first cost to use counter E. M. F. cells. Considerations of economy in use of current would likewise forbid adoption of wire or other dead resistance. In the case of a small current where there would be no object in using it economically lamp or wire resistance could be used. So far as first cost is concerned these forms of current equalizers are cheap as compared with other forms of apparatus. Fig. 2 shows an arrangement where a current at 500 volts is reduced to 58 volts—suitable for charging 25 strong battery cells. Of course the fluctuations in pressure in the power mains would be attended with great breakage of lamps. This method, therefore, cannot be considered economical except in such cases where the battery is of small ampere capacity and the lamps are used for lighting. Such an arrangement is adopted by the Western Union Telegraph Company, at its Allentown, Pa., office.

Where an economical use of the current is imperative, some other means of transforming a high-tension current into one meeting requirements becomes a matter of necessity. Apparatus constructed for this purpose and designed to effect this transformation with a high efficiency is used largely. Such machinery, styled variously motor-generators, motor-dynamos, dynamotors, direct current-transformers, etc., are built of various sizes, and have in the larger units

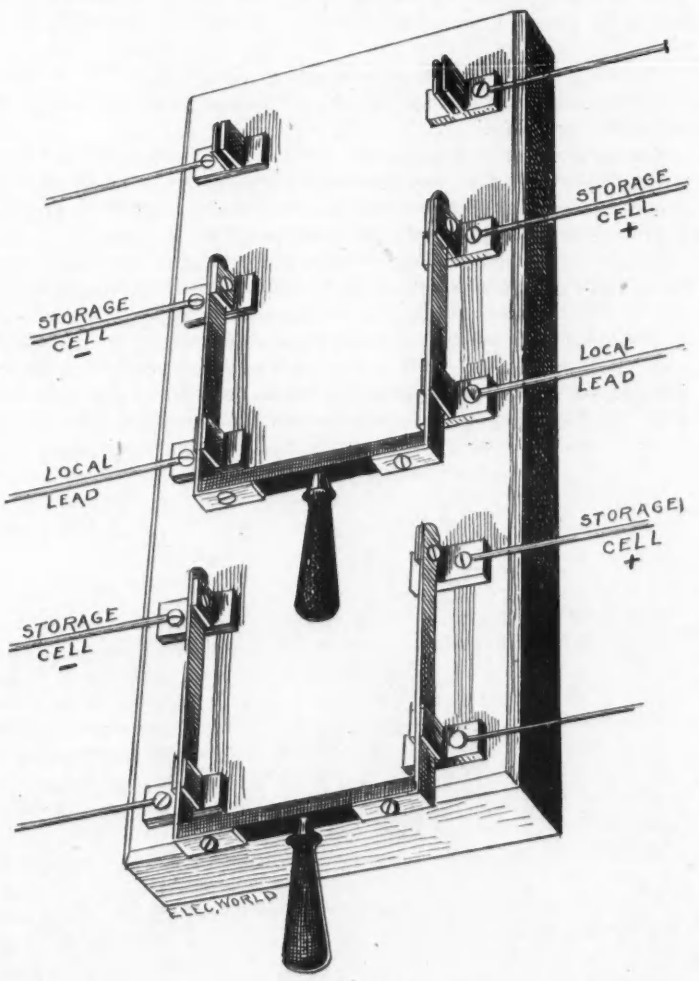


FIG. 5.

an efficiency as high as 85 per cent. They are constructed to be run from currents at 500, 220 or 110 volts, and to deliver current at any specified voltage. In the Atlanta, Ga., installation of the Western Union Telegraph Company there are two of these motor-dynamos; one, a 7½-hp machine, taking a 500-volt current from the mains of the Georgia Electric Light & Power Company, and transforming it into a 110-volt current; and the other, a 1-hp machine, utilizing the same 500-volt current, but transforming it down to a 16-volt current suitable for charging local cells. Fig. 3 shows these two motor-dynamos connected in between the electric light mains and the storage batteries. Of course the smaller machines will not effect the transformation of current with the same efficiency as the larger ones. The efficiency of small machines is not much above 40 per cent.

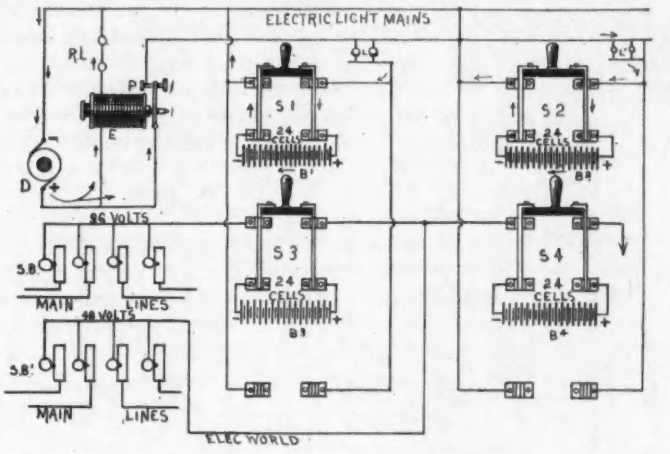


FIG. 6.

If, while charging a battery, the dynamo for any cause should slow down to a point where the E. M. F. of the charging current fell below that of the battery, the battery would begin to discharge the armature of the dynamo at a rate greatly in excess of the normal—in the mean time running the dynamo as a motor. As some damage might be done to the battery plates from an excessive discharge rate it is customary to insert, in the charging circuit, an automatic cut-out switch, Fig. 4. If at any time the voltage of the charging current falls below that of the battery, the magnetic effect on the armature will be diminished; gravity, acting then on the end of the armature, will overcome the magnetic effect and break the circuit before the back pressure from the storage battery will have renewed the attraction of the magnet for its armature.

The simplest and cheapest arrangement of a stationary storage battery is one in which the battery is left constantly charged, while current is being continuously drawn from it. Such an arrangement, however, does not presuppose much reserve capacity. In practice it is considered much safer to operate two sets of batteries; the extra expense of installation being deemed justified by the greater security which this method offers. Under this arrangement one set of cells is charged while the other is on the circuits. To put a charged battery on the circuits and an exhausted one on the charging leads is effected by means of a double-pole, double-throw switch, such as is shown in Fig. 5. By reference to Fig. 6, the manner of making connections is seen; also how two sets of cells may be interchanged and put alternately on the charging and discharging circuit, by simply reversing the positions of the switches.

(To be continued.)

Ageing Permanent Magnets.

According to Prof. Dewar, the best way of ageing a permanent magnet is to dip it several times into liquid air, as it then arrives at a constant condition.

Tempering by Electricity.

According to a Swiss contemporary, an engineer by the name of Tauxe has just invented a new process of tempering steel by electricity, which not only makes the steel much harder but at the same time gives it the proper elasticity, that is, it is not brittle like steel made very hard by the usual process.

A Popular Explanation of Hysteresis.

Prof. Ewing closed a recent lecture in London on hysteresis with words to the following extent: "If while he had been engaged in delivering one difficult sentence they [the audience] had been occupied in trying to understand the one which had preceded it, they were but exhibiting in their own minds a form of hysteresis!"

Experimental Tests on the Influence of the Shape of the Applied Potential Difference Wave on the Iron Losses of Transformers.

BY STANLEY BEETON, C. PERCY TAYLOR AND JAMES MARK BARR.

(*Continued from page 713.*)

DISCUSSION OF CURVES.

All the curves of P. D. and current given in the figures have been obtained by taking the means of the homologous readings on each half-wave. The mean wave thus determined was never found to differ appreciably in any way from the positive or negative half-wave. Each wave was drawn as the observations were made, so that, when the exact contour of the wave appeared doubtful, more

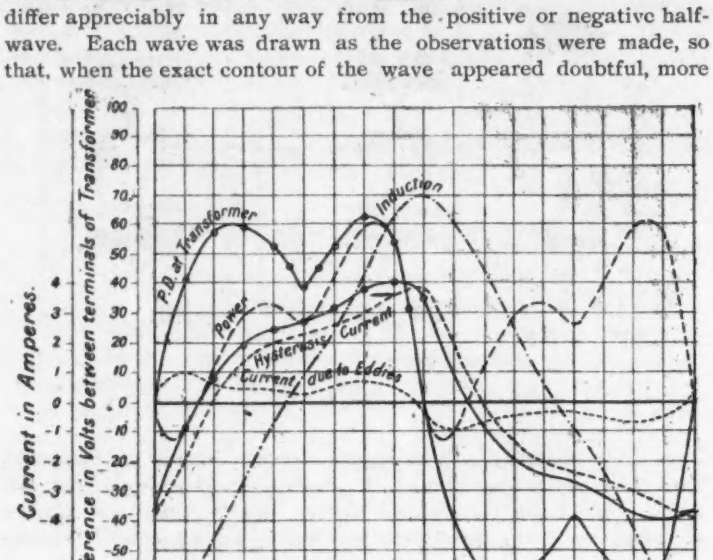


FIG. 4 G.

readings at points intermediate between those already observed could be *at once* taken and plotted; hence a large number of observations were made on every wave, sometimes as many as 48 points being taken.

The normal P. D. wave of the Ferranti alternator (Fig. 4 E, Plate 3) is seen to be very nearly a sine curve, while the current-wave possesses the characteristic deformation always observed when a transformer is working light.

Induction Waves.—The induction wave must be found by in-

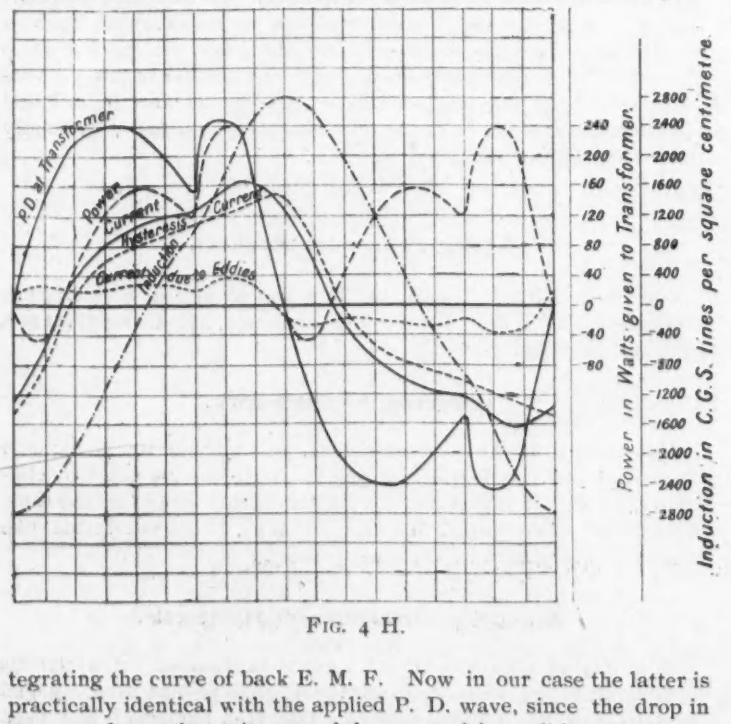


FIG. 4 H.

tegrating the curve of back E. M. F. Now in our case the latter is practically identical with the applied P. D. wave, since the drop in pressure due to the resistance of the magnetizing coil is negligible.

It is interesting to note how smooth the outlines of the induction curves are, even when derived from very distorted waves of potential difference. This point has been fully dealt with by Mr. Evershed in the articles referred to above. We have, therefore, to integrate the P. D. wave; but to do this, we require some starting point and this must first be found. When the ordinate which divides the half-wave of P. D. into two parts of equal area is known, this presents no difficulty, as the induction must be zero at the point where this ordinate cuts the axis of time. When, however, as is more often the case, we do not know this ordinate, then the above relation will not help us; but there is another relation which is true in every case, viz., *that the induction must be a maximum when the P. D. is zero.*

It is evident, on reference to Fig. 2, that, according to this relation, the induction must pass from a negative to a positive maximum, or *vice versa*, during the half-period of the P. D. wave. Since the induction wave is the integral of the P. D. curve, it will also be evident from Fig. 2 that *the area of the semi-wave of P. D.*, multiplied by the required constant, will give twice the maximum induction. (This constant must contain the number of turns in the

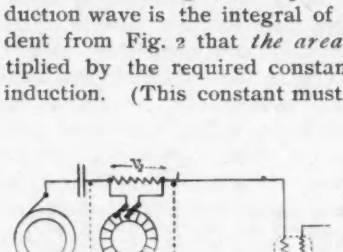


FIG. 5.

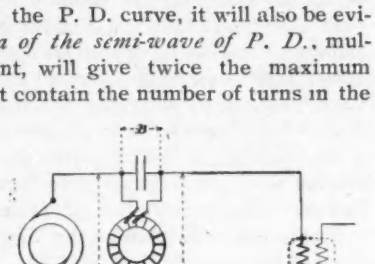


FIG. 6.

magnetizing coil and the cross-section of the iron core.) Thus, in every case, we can get a starting point for the induction curve by setting up the maximum induction at the point where the P. D. is zero.

The wave is then drawn by integrating the P. D. curve in steps from this point, and subtracting the inductions thus obtained from the maximum value.

This direct relation between the maximum induction and the area of the P. D. wave is of the greatest importance, for it is evident then that the *amount of hysteresis loss* for different shapes of applied P. D. waves will depend only on the *areas of these waves.*

Power Curve.—The actual mean power supplied to the transformer was determined by finding the products of corresponding instantaneous values of the applied P. D. and current. The products thus found were plotted as curves (see Figs. 3, and 4), which were then integrated with a planimeter, and the mean ordinate determined. This then gave us the input, and, since the copper loss was negligible—being less than one fifth of a watt—it represented

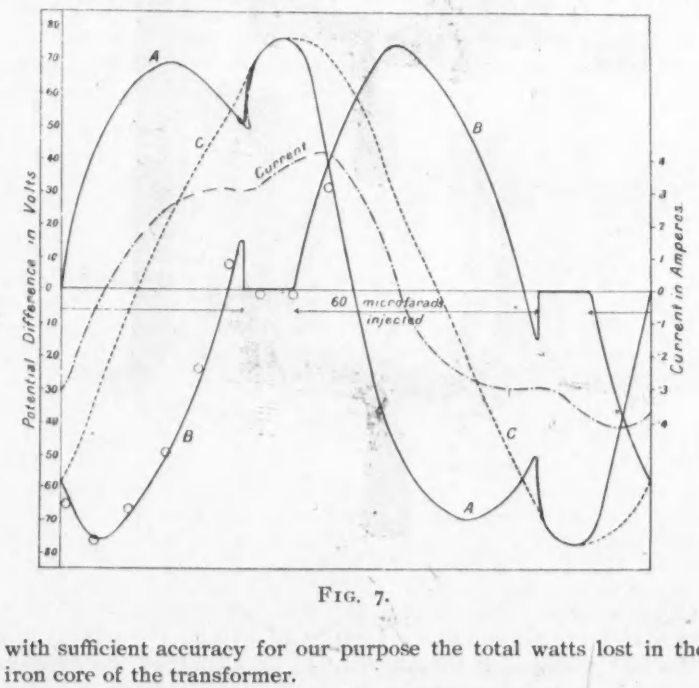


FIG. 7.

with sufficient accuracy for our purpose the total watts lost in the iron core of the transformer.

EFFECTS OF THE INJECTOR.

As this paper is essentially one dealing with transformer tests, we do not propose to discuss at any length the effects obtained by the

use of the injector, but it may be useful to consider one typical case of injected resistance and one of capacity. The effect of injecting rather a large resistance when the current is *not in phase* with the P. D. maintained between the terminals of the transformer is well illustrated by the wave shown in Fig. 3 A.

In this test, a resistance of 36 ohms was thrown in over the first part of the wave; but, in addition, we had a capacity of 96 microfarads *permanently* in the main circuit, which brought the current into phase with the P. D. between the terminals of the alternator. By bringing the current into phase with the P. D. we mean that the

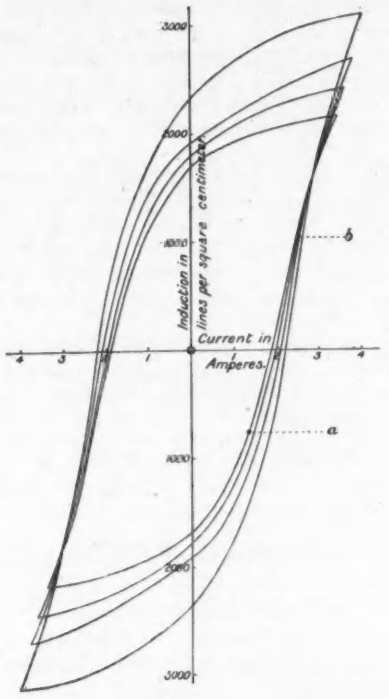


FIG. 8.

zero readings of the two waves occurred at the same point, but the waves, of course, possessed very different shapes.

The distinguishing feature of this wave is the curious sort of hump which occurs just at the beginning. The explanation of this is not hard to find. It will be observed that during the interval in which the current is opposite in sign to the P. D. the ordinates of the latter curve tend to increase, but directly the current-wave crosses the zero line the P. D. begins to decrease.

Consider for a moment the instantaneous P. D.'s between the terminals (1) of the machine and condenser, (2) of the injector, (3) of the transformer and resistance R, represented by v_1, v_2, v_3 (Fig. 5) respectively, during the interval just alluded to.

Since the current is in the opposite direction to the terminal P. D. of the transformer, we have:

$$v_1 = v_3 - v_2 ;$$
$$v_3 = v_1 + v_2 ;$$

that is to say, for this short interval the P. D. across the transformer equals the sum of the P. D.'s of the machine and the injector. This, then, fully accounts for the presence of the *hump*.

The effects obtained by the injection of capacity will be best explained by a reference to Fig. 6 and Fig. 7. In the latter we have shown (curve A) a P. D. wave at the terminals of the transformer and non-inductive resistance R (Fig. 6). This was obtained by adding, at each point, the drop in pressure due to this resistance to a curve obtained at the terminals of the transformer, and shown in Fig. 4 G. The interval during which the condenser (60 microfarads) was in circuit is also shown in Fig. 7, and the curve of P. D. between its terminals (*i. e.*, the brushes b_1, b_2, Fig. I.), marked B, was obtained by integrating the current-wave during this interval.

By combining these two waves we get the P. D. between the terminals of the alternator, shown in curve C. Since the condenser P. D. is obtained by integration, its maximum necessarily occurs when the current crosses the zero line. This maximum value is directly proportional to the area of the current-curve from the point of injection to its zero point, and inversely proportional to the capacity of the condensers injected.

On referring to Fig. 8 we note that, since the current is large when the condenser is thrown into circuit, the curve B rises very rapidly, and therefore the curve A turns down very rapidly away from curve C, and crosses the zero line where B and C cross each other. The maximum point of the condenser P. D. curve of course occurs at the same time as the maximum *difference* between curves A and C, and thus, when the curve B turns down, A bends over and begins to approach C, which it crosses when B crosses the zero line. Soon after this the condenser is short-circuited, and thus B follows the zero line and A is again coincident with the alternator P. D. curve, C. This coincidence lasts as long as the condenser is cut out of circuit by the "injector."

The points marked on the condenser potential difference, curve B, were obtained by experiment. They do not lie accurately on the curve, but this is probably due to slight sparking at the injector brushes, which made the electrometer readings somewhat unsteady when taking this wave.

Our chief object in taking points on this curve was to set at rest any fears that might have been entertained as to the advisability of periodically throwing in and removing from a circuit a bank of condensers. It has been shown that when a circuit possessing capacity in the form of condensers is broken there may be a sudden rise of potentials at the terminals of the latter. No such rise of P. D. was observed in our experiments, and this was due to the fact that the condenser circuit was *never really broken*, for the capacity was removed from the circuit by being short-circuited.

DISCUSSION OF RESULTS.

Our great aim at the time of carrying out these experiments was to find some definite *law* connecting the iron loss in the transformer with the shape of the applied P. D. wave. In no work published on the subject at that time could we find any results or conclusions which could form the basis of a connected theory regarding this question. None of the investigations on this subject had justified any conclusion which could materially help in judging of the exact, or even relative, value of wave forms not actually tried.

The conclusions that we came to were:

First: That if the R. M. S. value of the applied P. D. is constant, and the area of the P. D. wave is constant, then, whatever be the shape of this wave, the total iron loss cannot vary.

Second: That if the R. M. S. value of the applied P. D. is constant, but the area of the P. D. wave varies, then, whatever be the shape of this wave, the total iron loss will vary by an amount which is only dependent upon the area of the P. D. wave.

We feel fully justified in coming to these conclusions, for, as we have shown above, the hysteresis loss depends only on the area of the P. D. wave, and *we have proved experimentally that the eddy-*

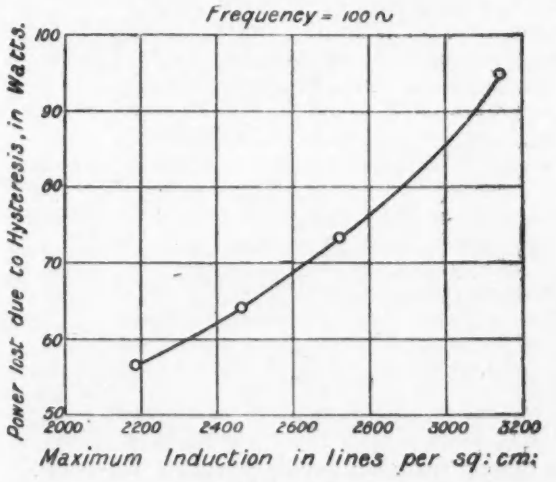


FIG. 9.

current loss is constant for a given effective P. D. This we refer to again below.

The results calculated from our tests will be found in as concise a form as possible in Table I.

Hysteresis Tests.—In order to get a complete theory regarding the iron losses, it was essential that we should separate those due to hysteresis and to eddy-currents. To determine the former loss, then, hysteresis tests were made on the transformer itself by a method independently suggested and used by Prof. Ewing[10] and Dr. Hopkinson. We found this method most satisfactory. The two 12-turn

[10] Paper on Magnetic Qualities of Iron, Royal Society, April, 1894.

coils of the transformer were used, one as the magnetizing and the other as the test coil. A large resistance was put in series with the magnetizing coil to reduce the time constant of the circuit.

The magnetizing current was measured by means of a standard Weston ammeter, while in series with the test coil we had an Ayrton and Mather narrow-coil ballistic galvanometer, which was standardized with one of Hibbert's magnetic standards. In this way four complete B. H. cycles, as shown in Fig. 8, were determined for the transformer.

They were integrated with an Amsler polar planimeter, and the results obtained were plotted to show the relation between the maximum induction and power lost in hysteresis, at a frequency of 100 ∽. This curve is shown in Fig. 9.

The hysteresis loss for each test was obtained by calculating the maximum induction as previously shown, and referring to this curve, and the eddy-current loss by subtracting this from the total.

Variation of Applied P.D.—It will be observed, on reference to Table I, that the effective values of the applied potential difference are not all the same ; they vary between 48 and 50 volts. This is due to the fact that they are not instrument readings, but are calculated from the curves by means of the first moment planimeter. The method of using this instrument to give the R.M.S. value of a curve was described in the articles referred to elsewhere.[11] It was due originally to Mr. Turner, one of the demonstrators in the mathematical department of the Central Technical College.

We have given preference to this method of obtaining the effective values of both P. D. and current mainly for two reasons, viz. Firstly, far greater accuracy is attainable by this method. This is easily understood when it is remembered that, by increasing the number of water-cells used in conjunction with the electrometer, this instrument could be made as sensitive as we wanted, whereas the sensibility of the voltmeter was fixed. Secondly, by calculating *all* results from the curves of P. D. and current, any small errors which arise from inaccurate readings or drawing appear in them all, and these are made of far less relative importance.

The voltmeter, *V*, (Fig. 1), was therefore only used to keep the effective value of the P. D. constant throughout each test, and it was not specially calibrated.

This method of calculating the results has, however, introduced some difficulty in drawing conclusions from our experiments, as the small variations in effective P. D. must be taken into consideration. The difficulty of arriving at the true effect of this variation arises mainly from the fact that the eddy-current loss has been obtained by taking the difference of two much larger quantities, and thus the probable error is a large percentage of the whole range of variation. After a careful study of columns 2 and 7 of Table I, we came to the conclusion that, within the limits of accuracy attainable by our experiments—*i. e.*, about ½ per cent.—the eddy-current loss is proportional to the square of the applied P. D. This leads at once to the further conclusion that *the eddy-current loss is independent of the wave form of P.D. so long as its R. M. S. value is constant.*

Table I.—Results of Transformer Tests Calculated From Curves.

Figure.	R. M. S. or Effective Values.		Apparent Power in Watts.	Iron Losses in Watts.			Power-Factor.	Maximum Induction in Lines per Sq. Cm
	P. D. in Volts.	Current in Amperes		Total.	Hysteresis.	Eddy Currents.		
3 A	49.5	2.42	120.0	92.5	60.5	32.0	0.77	2330
3 B	49.8	2.75	137.0	95.5	63 0	32.5	0 70	2410
3 C	48.5	2.81	136 0	93.5	65.0	28.5	0.69	2490
3 D	48.9	2.95	144.5	97.5	66.0	31.5	0.67	2520
4 E	49 2	3.03	149.0	103.0	71.0	32.0	0 69	2680
4 F	48.1	2.92	140.5	104.5	74.0	30.5	0.75	2750
4 G	49.5	2 80	138.5	111.0	76.5	34 5	0.80	2800
4 H	48.1	2.85	137.0	106.0	76.0	30.0	0 77	2790

In order that this variation of applied P. D. should not obscure the true meaning of our results, we have calculated by known laws the difference in the iron losses produced by the difference in the value of the applied P. D. from 50 volts, and thus found the iron losses for each wave-shape corresponding to an applied P. D. of 50 volts. The methods of correction employed were as follows :

The effect of variations in the R. M. S. value of the P. D. is most marked in the case of the eddy-current loss, so that we will deal with this first.

We have, then, here corrected the eddy-current loss to a value corresponding to a common effective applied P. D. of 50 volts. In doing this, since each test is corrected separately, we only assume that, *so long as the wave-shape of P. D. is constant*, the eddy-current loss varies as the square of the effective volts.

Table II.—Results of Tests Corrected for a Common Effective P. D. of 50 Volts.

Figure.	R. M. S. or Effective P. D. in Volts.	Maximum Induction in Lines per Sq.Cm.	Iron Losses in Watts.		
			Hysteresis	Eddy-Currents.	Total.
2 A	50	2350	61.0	32.5	93.5
3 B	50	2420	63.0	32.5	95.5
3 C	50	2560	67.0	30.0	97.0
3 D	50	2570	67.5	33 0	100 5
4 E	50	2720	73.0	33.0	106 0
4 F	50	2850	79.0	33.0	112.0
4 G	50	2830	78.0	35.0	113.0
4 H	50	2900	82.0	32.5	114.5

From Table II. we see that, with the exception of the tests shown in Fig. 3 C and Fig. 4 G, the eddy-current loss is practically constant ; the variation of half a watt meaning only ½ per cent. in the determination of the total loss.

(*To be continued.*)

[11] *Electrician*, July, 1895, vol. xxxv., p. 290.

Röntgen-Ray Negatives.

To the Editor of The Electrical World:

Sir :—I enclose a print from an X-ray negative. There is, of course, nothing remarkable about the picture itself. I send it to you as the negative from which it was made was exposed to the X-rays with the *glass* side up instead of the film, as is usual.

My impression had been, up to the present, that the plate would be unacted on unless the film were uppermost, and, so far, have not seen the contrary stated in any of the numerous articles published on this subject. I stumbled on the fact quite accidentally.

I have exposed two similar plates at and for the same time, side by side, to the action of the tube, one film up, the other film down. Both were simultaneously developed in the same tray. The one having had the film up was the more intense but the second was quite distinct.

The plates used were Stanley's No. 35, and were about 1 mm thick.

J. B. Cochrane.

Royal Military College, Kingston, Canada.

Moore Vacuum Tubes.

To the Editor of The Electrical World:

Sir:—Mr. Moore, in his statements regarding the operation of his vacuum tubes, says that he gets the great effect principally by the use of a vacuum break. Whether he claims this as his own invention I do not know, but that it has been used I do know, and not having seen anything to give the credit to the originator, I beg to call attention to Fleming's "The Alternate-Current Transformer," Vol II, p. 44, First Edition. He says: "Poggendorf examined very carefully the action of the contact-breaker, both when operating in air as well as when immersed in various liquids, and also when in a good vacuum. * * * He made the curious observation that when the contact-breaker of the primary circuit operated in a good vacuum its action lengthening the secondary spark was so much increased that it produced very nearly the same effects when acting without a condenser as did a contact-breaker provided with a condenser in air."

This statement was originally made, I think, in 1855, as contemporaneous experiments were recorded about that time.

I do not wish to detract from the value of Mr. Moore's researches, but many are under the impression that the vacuum break is original with him, and this may serve to enlighten them.

John F. Petz.

Peoria, Ill.

DIGEST
OF CURRENT TECHNICAL ELECTRICAL LITERATURE
BY CARL HERING
COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Alternate-Current Dynamo-Electric Machines. HOPKINSON and WILSON. Lond. *Elec. Rev.*, May 29.—The beginning of a reprint in full of a Royal Society paper read May 2, 1895; it is also reprinted in full in the *Philosophical Transactions of the Royal Society*, Vol. 187, page 229, and may be obtained under separate cover; an abstract of this paper appeared in THE ELECTRICAL WORLD, June 22, 1895, page 711. The paper deals experimentally with the current induced in the coils and in the cores of the magnets of alternate-current machines by the varying currents and by the varying positions of the armature; it is shown that such currents exist and that they have the effect of diminishing to a certain extent the E. M. F. of the machine when it is working on resistances as a generator without having a corresponding effect upon the phase of the armature current; it is also shown that preventing variations in the coils of the electromagnet does not, in the machine experimented upon, greatly affect the result, and that the effect of introducing copper plates between the magnets and the armature has not a very great effect upon the E. M. F. of the armature, the conclusion being that the conductivity of the iron cores is sufficient to produce the main part of the effect. A method of determining the efficiency of alternate-current machines is illustrated, and the results of the experiments for this determination are utilized to show that in certain cases of relation of phase of current to phase of E. M. F. the effect of the local currents in the iron cores is to increase instead of to diminish the E. M. F. of the machine. It includes a large number of curves and tables.

Maximum Efficiency of Transformers. SCATTERGOOD. Lond. *Elec.*, May 29.—In designing a transformer for any particular load curve, it is desirable to have the mean efficiency of the transformer, when averaged over the whole day's output, as high as possible; the point at which the efficiency ought to be a maximum will vary with the form of the load curve; by means of simple mathematics he develops formulas for calculating the load at which a maximum efficiency is reached, and another for calculating this efficiency. Let C be the current passing through the secondary, E the secondary terminal voltage, w the iron losses in watts and $p\,C^2$ the copper losses for that current, p being therefore a constant which is a function of the resistance of the two windings and of the secondary terminal voltage; then the current C at which the maximum efficiency is reached is given by the following formula

$$C = \sqrt{\frac{w}{p}}$$

and the efficiency at this load is given by the formula

$$\frac{E}{E + 2\sqrt{p\,w}}.$$

He furthermore shows that there is only a very small error introduced by taking in the above formulas the open circuit value of the voltage, instead of the value as effected by the drop.

Alternating-Current Transformer. MORSE and PFEFFER. *The Technograph*, No. 10, May, 1896 (an annual published by the Association of Engineering Societies in the University of Illinois).—A full account of comparative tests made by them on 12 transformers of as many different makes, the object of the test being to obtain independent data representative of the American transformers of moderate capacities; transformers of about 1500 watts were produced directly from the manufacturers within a year, and the tests may therefore be presumed to represent the latest and best designs which are now supplied. The theory of the transformer and the methods used are given in full, as also the results in tabular form; the curves of efficiency, primary and secondary current, total loss and resistance loss are given for two transformers, showing the variation in those two cases. In their conclusions they show the great saving that might be effected in any particular system of distribution when care is exercised in the choice of the transformer which will give the highest all-day efficiency for that system.

Motor Control. BURKE. *Elec. Eng.*, June 10.—A reply to the recent criticism of Anthony (see *Digest*, May 16). He claims that Anthony considered an entirely different problem, in which the conditions are quite different; he compared Burke's method, when applied to the problem of constant torque, with a system in which a rotary transformer is used, but if the comparison were made on the basis of constant power, Burke states that the conclusions become reversed. He furthermore believes that the regulation suggested by Anthony, namely, by weakening the field through a wide range, is impracticable; his conclusions are based on the results of tests made to determine the limits of speed, controlled by field variation. A number of methods of speed control have been devised, but each is applied to some special problem or class of work, and they should not be misapplied.

Alternating-Current Motors. SWENSON. *The Technograph*, May, 1896, (University of Illinois).—An article of a general nature, giving the principles of the various forms of alternating-current motors.

LIGHTS AND LIGHTING.

High Voltage or High Efficiency Lamps. GRUENWALD. *Elek. Anz.*, May 21.—A brief article discussing the relative merits of 2.5 watt lamps at 100 volts, and 4-watt lamps at 220 volts, his conclusions being in favor of the former; he makes a calculation for a plant of 100 lamps at a distance of 100 metres; he assumes the life of the high-voltage lamp to be 1000 hours and the mean efficiency 4.5 watts during this time, the life of the high efficiency lamp is taken as 500 hours and the mean efficiency 2.71 watts; he calculates the cost of running for a year, showing quite a large proportion in favor of the high-efficiency low-voltage lamps.

Electric Lighting of Passenger Cars. Eng. News, June 11.—Good results with storage batteries are being obtained on the Cape Government railway, where they are in use on express trains making a round trip of nearly 2000 miles and occupying three nights, although during the third night the batteries are sometimes exhausted. A direct-lighting trial is being made with a dynamo driven by an oil engine, the success being apparently greater than that with accumulators.

POWER AND HEAT.

Utilization of Small Water-Powers. STEIGER. Lond. *Elec.* and *Elec. Eng.*, May 29.—The beginning of a reprint, with illustrations, of an Institution paper in which he proves that excellent results are obtainable with very low falls of even less than three feet; the present portion is devoted entirely to descriptions of various turbines for small heights and includes a table giving their efficiencies, from which it appears that the smaller the fall the greater is the gain in power of these wheels over the old-fashioned water-wheels; other examples are to be given of plants for the generation of electrical energy.

Portable Electric Painting Plant. Lond. *Elec.*, May 29.—An illustration of a plant used on the Liverpool elevated railway; the whole plant is mounted on wheels, and contains an electric motor which drives the force pump of a spraying painter, the current being taken from the railway circuits; the apparatus is carried on a car which is run on the street below the overhead structure; it replaces 40 hands which have heretofore been required for painting the girders, and it is thought that great economy of time and labor will be effected by this apparatus.

Long-Distance Transmission. SHOCK. *St. Ry. Jour.*, June.—A reprint of a short paper read before the California Street Railway Association, giving a brief description of the Sacramento plant.

TRACTION.

Series Trolley System. Elek. Zeit., May 28.—A brief, illustrated description of the CATTORI system, which is in use in Rome; the wires are in a conduit under one of the tracks, in sections which are shorter than the length of a car; the contact shoe opens the circuit between two sections so that the current must pass through the car; during the trial trips the contact shoe opened one of the contacts 20,000 times, which was considered very satisfactory.

Secondary Batteries for Locomotion. FITZ-GERALD. Lond. *Elec. Rev.*, May 29; a continuation of his serial (see *Digest*, May 30).—He discusses the subject of perfect and extended contact of the grid with the active material, involving a limited current density; he compares the grid form with those in which there is a layer of active material on the surface of the conductor, that is, in general those of the Planté form, comparing the weights and surfaces mathematically, but giving no general conclusions. He states that experimental results are accumulating in support of the conclusion that when certain precautions are adopted in forming, then methods of packing other than that adopted for the grid support, may be quite as efficacious in maintaining the contact with the active material; evidence is also accumulating to show that an embedded conductor may be protected to a very great extent from the effects of local action.

Electrolytic Action in the Return Circuit. BELL. *St. Ry. Jour.*, June.—A continuation of his serial on power distribution for electric railways.

He shows what a serious matter electrolytic corrosion of water pipes is, stating as an example that one ampere will eat away nearly 20 pounds of iron per year or about 75 pounds of lead; he gives the experience obtained in Boston, discusses the subject in general and shows the large amount of power wasted if the resistance of the return circuit is not low; in one case, for instance, which he says is a very common one, the loss of power amounted to $750 per year. To prevent electrolytic destruction of neighboring conductors he advises as follows: Use the continuous-rail system or bond very thoroughly; connect the positive pole to the overhead line and join the negative directly to the track without intervening earth connections; in any case investigate the potential between the track and buried conductor and run supplementary wires from these conductors to the dynamo if necessary. He then discusses the total net value of the return circuit as a conductor compared with the outgoing circuit; he shows the relation between the track resistance and the overhead resistance under various circumstances; the general assumption that the track resistance is one quarter of that of the overhead system really represents a better state of things than usually exists; under the ordinary conditions the track resistance may be taken as equal to 0.4 times the overhead resistance; he shows how the formula for the overhead line must be modified to take into account the resistance of the return circuit, a formula which he intends to apply in the next article.

Third-Rail Tests on the Nantasket Beach Road. Elec. Eng., June 10.—The experimental third-rail plant was thoroughly tested recently, and it is almost definitely settled that the overhead system now in use will be abandoned on that road in favor of the third rail, contracts having been already made for the equipment of part of the line. It was effectually demonstrated that great speed and efficiency could be obtained fully as great, if not greater, than with the overhead system; the rail is alive throughout; it is broad and flat, having a flange at each edge reaching around the supporting blocks of wood; the contact is made by means of a shoe; the whole structure projects about 1.5 inches above the rails.

Efficiency of Compressed-Air Traction. Lundell. *Elec. Eng.*, June 10.—A short article in reply to a recent pamphlet by Herman Haupt, and to recent newspaper reports; he endeavors to correct the erroneous impressions created by them regarding the question of efficiency, which he investigates mathematically, and concludes that the total plant efficiency would be 21 per cent. under the most favorable conditions; reheating of the air at the pressure-reducing valve is absolutely necessary.

Bergen County Traction Company. St. Ry. Jour., June.—A long, well-illustrated description of this system.

Location of Trolley Wire on Curves. Foster. *St. Ry. Jour.*, June.—A short article showing how the correct position may be determined.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Effect on the Voltage of Unequal Loading of the Branches of a Three-phase System. Rasch. *Elek. Zeit.*, May 28.—He develops comparatively simple formulas for calculating the effect of unequal loading; he compares the star with the triangular system of connection; his formulas show more favorable results for the star connection; the calculation of the resistance in this case was based on equal outputs, equal voltage, and equal losses; if, however, the calculation is made for equal amounts of copper, the resistance for the triangular system is appreciably lower, and his formulas then show that the irregularities in this system will decrease quite appreciably; contrary to what was stated by others, he shows that, other conditions being the same, the triangular system requires a much less quantity of copper than the star system, although in the former the current is 73 per cent. greater; in the triangular system, however, the loss of voltage and the useful voltage are not the same, but are in different phases, differing by 90 degrees; in the triangular system the irregularities in the terminal voltage will be appreciably less; the results are, however, different if the rise in temperature limits the use of larger cross-sections than if the calculation is based on a certain drop in voltage; the star connection then requires only half the cross-section of that in the triangular system; but the question can still be asked, whether the saving in copper is not balanced by the cost of the insulation of a fourth wire.

Cost of Operating Central Stations. Lond. *Lightning*, May 7.—An article giving tabulated summaries compiled from the weekly tables issued by that journal in order to critically examine the results achieved by existing stations in that country with the object of enabling one to find the proper outcome of new stations without having to make calculations based on more or less problematical data; it is largely of local interest; there are no general conclusions drawn.

Norwich. Lond. *Engineering*, May 29.—A long, well-illustrated description of this station which is spoken of very favorably as it has been a very successful one; a three-wire, low-tension, direct-current system is used, with accumulators for the light load, enabling the station to be shut down at night; there are six sets of triple-compound engines of 100 to 200 horse-power, some of them coupled to two dynamos; the current for charging the accumulator is taken off the bus-bars and passes through a booster; there is also a set of accumulators at a sub-station over a mile distant in a residential part of the city, the cells there being charged during the daytime from the ordinary mains with a comparatively small current.

The Best Distance Between Transformers. Pojatzi. *Elek. Zeit.*, May 28.—He refers to the recent article of Haas (see *Digest*, March 21), and gives a more general solution of the problem.

Descriptive Index of Typical Central Stations and Isolated Plants. Esty. *The Technograph* (the annual published by the Engineering Societies of the University of Illinois, Urbana, Ill.) May, 1896.—It contains condensed data concerning 134 plants, divided as follows: Power, 52; lighting, 49; combined light and power, 17; isolated, 16. The scope of the Index may be illustrated by the following extract: "Electric Lighting, Heating and Power Plant of the New Boston & Maine and Fitchburg R. R. Union Station, Boston, 4 pp., A. C. Shaw. Full description, with plan of station, engravings, etc., four Westinghouse 'Kodak' comp. cond. engines, 14 x 24 x 14 inch, direct-connected to 125-kw generators. Two of 125 volts; two of 500 volts. Another similar engine is belted to a 2200-light Westinghouse alternator, and a 11 x 19 x 11 inch engine is belted to a 1100-light alternator. A T.-H. 62-kw bipolar generator giving 220 volts runs the elevators. E. E. 17:485, June 6, 1894; Eng. Rec., June 2, 1894." The author states that he did not attempt to make the Index exhaustive, as it dates back only to 1889, and only such journals as were readily accessible have been consulted. Reference is made to about a dozen periodicals, American and foreign, but The Electrical World and *Electrical Engineer* have furnished the greater part of the material used. Some help was obtained from the various published indexes, but this information is incomplete and widely scattered, so that in most cases the original articles had to be looked up, carefully read, and the digest made. The list of stations chosen is not intended to include only the best or the most important examples of design, but is rather a collection of stations representing American and foreign practice, good, bad and indifferent. The Index was compiled by the author primarily to aid his students in the design of electric light and power plants, but it will be found of great value to practicing engineers as well in getting data on existing plants easily and quickly. A list of indexes to engineering literature is included.

Controllable Junction Boxes and Feeder Switching System. Elec. Eng., June 10.—An illustrated description of this system used by the New York Edison Company.

WIRES, WIRING AND CONDUITS.

Manhole Explosions and Their Remedy. Dobbs. *Elec. Eng.*, June 10.—He explains the cause of the recent explosions of four manholes in Brooklyn and suggests the following remedies: When it is necessary to ground a cable it cannot be done too well; when cables are strung under the elevated roads, connect them to the suspension wires every thousand feet, the current being then largely shunted to the elevated road instead of into the manholes; had they been grounded at the manholes there should have been no spark; if a cable must be insulated, as in creosoted conduits, care should be taken that the insulation is maintained.

ELECTRO-PHYSICS AND MAGNETISM.

Röntgen-Ray Tubes. Chaband and Hurmuzescu. *L'Ind. Elec.*, May 25.—A reprint, with the illustrations, of a short Academy paper, in which they show the relation between the maximum production of X-rays, the degree of vacuum and the form of the tubes; Chappuis showed that with the ordinary pear-shaped tubes the maximum occurs for a vacuum of 0.001 mm; the present writers show that this maximum is not the same degree for tubes having quite different forms; they give the results for a cylindrical tube having a maximum at about 0.01 mm, and show that by simply changing the form of the tube it is adapted to higher pressures; this latter form of tube, which is cylindrical, contains a cathode at one end, an anode entering it sideways near the other, but not in the cylinder itself, and the far end ending in a sphere, the same results are obtained with relatively poor vacuums, as in tubes in which the vacuum is much higher; in one form in which the anode is a disc in the cylinder itself, no luminescence was produced on the walls of the tube beyond; with such tubes effects can be produced which are better than those with the usual forms; in such a tube constructed by Chaband the cathode was concave and almost as large as the internal diameter of the tube; at the focus there is a disc of aluminum forming the anode and placed at a short distance from the wall of the tube; it has given a much more sharply defined image in a shorter time, which is thought to be due to the point of emission being quite near the walls of the tube, as the rays where they strike the glass can produce new centres of emission, this surface of glass being in these tubes smaller than in the usual forms; such tubes have the property that their life is longer and the current may be reversed without fear of altering them; both of these properties are said to be due to the use of aluminum electrodes.

Experiments with Hittorf Tubes and Röntgen Rays. Roiti. Lond. *Elec.*, May 29; an illustrated paper translated from the Italian, which was read March 1.—He describes a number of experiments; he discusses shadows and penumbras and endeavors to find the geometric point from which the rays emanate; he always found penumbras, even if the cathode rays proceeded from that point, however short the distance; in another test he obtained well-marked impressions when the objects were close to the photographic plate, but they disappeared when the distance was

greater, and he attributes this disappearance to the radiations from the walls of the glass, which in order to emit rays does not need to be fluorescent. He describes the behavior of a tube during exhaustion showing three distinct stages; he was able to obtain the magnification of objects from two to seven times with quite well-defined outlines; he found that fluorescence did not appear to be a necessary condition of the emission of these rays, as it seems to be possible to produce them without any fluorescence; he shows how complicated the phenomena are and how necessary it is to describe minutely all the circumstances under which the observations were made; the transparency of certain plates may vary with the variation of their distance from the surface of emission of the rays; to glass and aluminum are now to be added mica, platinum and porcelain as substances which emit these rays when exposed to cathode rays.

Röntgen Rays in Tubes Containing Rarefied Hydrogen. ARNO. *Transactions of the Royal Academy of Sciences of Turin;* abstracted briefly in the Lond. *Elec. Rev.*, May 29.—Starting with the hypothesis that the fact that the best working conditions occur after some hours of use, is to be ascribed to an absorption of the gases in the tube, he made an experiment with electrodes of platinum containing occluded hydrogen gas, in which case the best condition of the tube should occur in a much shorter time; the intensity of the radiation depends also on the degree of rarefaction and on the nature of the gas; the velocity of the cathode rays is inversely proportional to the electrochemical equivalent of the gas; with hydrogen, therefore, the electrochemical equivalent of which is less than that of air, the intensity of the Röntgen rays should be greater. (The translation from which this is taken is not clear.)

Radiographs. IMBERT and BERTIN-SANS. *L'Ind. Elec.*, May 25.—A short Academy paper describing experiments for studying articular movements of the body; by this means they can find much better than by dissection the multiple articulations of regions of the body during different movements.

Sparking Distance and Ultra-Violet Light. SWYNGEDAUW. *L'Eclairage Elec.*, May 23.—An Academy paper, interpreting the recent experiments of Jaumann.

Dielectrics. APPLEYARD. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, May 29; a brief extract of a Physical Society paper.—He investigated the effect of temperature on dielectric resistance; he found the capacity of a paraffine condenser varies irregularly with the temperature, but that within 1 per cent. the capacity of a mica condenser is constant between 33 and 110 degrees Fahr.; he used a Price guard-ring in his tests (this was illustrated in the *Digest*, Dec. 28). Prof. Ayrton in the discussion pointed out the great value of this guard-ring as it did away completely with the necessity for the extreme care previously necessary to prevent errors due to surface leakage.

Electrical Trevelyan Rocker. VAUGHTON. Lond. *Elec.*, May 29.—An illustrated description of an instrument consisting of a piece of bent steel spring, secured at one end and resting lightly against a metallic rod a short distance from the support, leaving about two thirds of the spring projecting beyond the rod; the whole is screwed to a wooden sounding-box; in regulating the pressure with which the spring presses against the rod, a point will be found at which the spring will vibrate freely and if a current is then passed through from the fixed end of the spring to the metallic rod, the vibrations will be maintained; there is no visible sparking and there seems to be no interruption of the current, the phenomena appearing to be due to heat generating at the point of contact; other metals do not answer as well for the spring.

Lag and Lead. HARRISON. Lond. *Lightning*, May 28.—A reply to the statement of Mordey (see *Digest*, last week). He approves of the recent criticism in the Lond. *Elec.* which to him is conclusive; it is there stated that it would introduce a curious discontinuity to conceive that the slightest trace of capacity in a non-inductive circuit would produce a lag of a whole period, whereas the slightest increment of that trace would cause only a small diminution in that enormous lag, while all the capacity that could possibly be introduced would only reduce the lag to three fourths of a period. He states that a current leading a quarter phase does not imply that an effect is preceding its cause; the statement that a current is only a quarter of a phase ahead of a certain E. M. F. is often supposed to mean that the current is ahead in time, that is, that it begins to flow before the switch is closed, which is obviously impossible; Mordey's statement that the current is three fourths of a period behind the E. M. F. might lead one to believe that this E. M. F. raised to a maximum, died away and reached its maximum in the opposite sense before the current started; Harrison thinks it just as difficult to understand why the E. M. F. produced no current for all this time after contact had been made, as to believe that the current started before the E. M. F. was complete; Mordey stated that the current in a circuit containing self-induction is not in phase with the applied E. M. F., but is in phase with the resultant E. M. F.; it follows from this, according to Harrison, that as two E. M. F s. in quadrature have a resultant larger than either of them, yet this resultant is daily made less than the applied, by the introduction of self-induction; this is possible because the E. M. F. of self-induction is in quadrature with the resultant E. M. F. and current, and not with the applied E. M. F. as stated by Mordey; to accept Mordey's statement compels one to believe that energy could be created with the aid of alternating currents. The subject is also discussed editorially in which a difference is expressed with Mordey; as an illustration, suppose a battery, a non-inductive resistance and a condenser be connected in series, then a current will flow for a time depending on the resistance and the capacity, it will diminish and finally cease altogether; if, instead of a battery an E. M. F. which is at first small is used and which rises to a maximum and then diminishes, the current will also rise and will attain its maximum before the E. M. F. has reached its greatest value, for precisely the same reason that it falls continually in the former case where the E. M. F. is constant; to say that the current reaches its maximum before the E. M. F. is considered to be the same thing as to say that its phase is in advance.

Phase-Shifting in Single and Tri-phase Systems. RODET. *L'Ind. Elec.*, May 25.—A simple mathematical and graphical discussion giving comparatively simple formulas for calculating the phase-shifting at the distant end and at the generating end.

Fundamental Laws of Induction. HOSPITALIER. *L'Ind. Elec.*, May 25.—A reprint in full of a recent Academy paper by Deprez, giving his theories; this is followed by a very unfavorable criticism; the original paper is also reprinted in *L'Elec.*, May 30, and *L'Eclairage Elec.*, May 23.

Magnetic Properties of Iron and Steel. Lond. *Elec. Rev.*, May 29; an abstract of two communications read before the Institution of Civil Engineers.—In one by Prof. EWING he points out the importance of magnetic testing of iron and steel, stating that this is no longer a laboratory experiment but has passed into the rank of an engineering operation; iron makers now produce a material greatly superior to that made two or three years ago; the best steel castings are somewhat better now magnetically than most forged iron; iron is now readily obtainable with only half the amount of hysteresis which was considered possible a few years ago; a brief description of his permeability meter is given (see *Digest*, May 30); permeability tests of a number of metals are given in the original paper in the form of tables and curves. In a second paper by PARSHALL he pointed out the more or less intimate relationship between the magnetic results and the chemical analysis; in general a greater degree of purity was an indication of higher permeability; chemical analysis can be taken only as an approximate indication; carbon is the most important element, the permeability being inversely as the amount of carbon present; the limitation of the state of the physical structure is greatly affected by the state of the carbon, that is whether free or combined; the effect of graphite is second in importance to that of the carbide; hysteresis loss is in general inversely as the degree of purity, and in comparatively poor irons it is determined practically by the annealing, heating and mechanical straining.

Magnetism at Low Temperature. DEWAR and FLEMING. Lond. *Elec. Eng.*, May 29.—A brief abstract of a Royal Society paper describing a number of investigations made at extremely low temperatures such as that of liquid air minus 185 degrees; the conclusions are given in abstract, one of the most important of which is a statement that one of the best ways of ageing a permanent magnet is to dip it several times into liquid air, as it then arrives at a constant condition in which subsequent temperature changes have a definite effect; with a soft iron magnet the curious fact is noticed that while a rapid cooling by plunging into liquid air hardly produced any effect on the magnetic moment after the first initial loss, the effect of the slow cooling was always to produce a permanent diminution of the magnetic moment.

Magnetic Field Due to an Elliptical Current. JONES. A Physical Society paper mentioned in the London journals, May 29.—The subject is "The Magnetic Field Due to an Elliptical Current at a Point in the Plane of the Ellipse and Within it"; it is of a mathematical character; when the correction described is applied to his measurements of the true ohm it brought the international ohm more nearly in accord with it; his present value is 106.302.

Hysteresis. EWING. Lond. *Elec. Eng.*, May 29; an abstract of a recent lecture at the Royal Institution. It is of interest but appears to contain nothing new.

Increasing the Striking Distance of a Given E. M. F. SKINNER. *Elec. Eng.*, June 10.—A short article describing a method for accomplishing this; he found that by placing a glass plate over the rounded terminals, and a sheet of tinfoil on the other side extending over the whole spark gap, connecting it to one of the terminals, the sparking distance of a given E. M. F. became many times greater than could be obtained if the glass plate and tinfoil were removed, or if the connection between the latter and one of the terminals be broken. With a transformer generating 35,000 volts the striking distance in air was 0 7 inch while with the present device it was 5 to 6 inches; a condenser connected in series between the terminal and the tinfoil did not materially affect the result; duplicating the tinfoil and the glass plate on the opposite side of the terminals gave a slightly increased result; connecting the two plates to opposite terminals gave the same result; the striking distance could easily be increased more than tenfold; similar results were obtained with discharges from static machines; he suggests that it might be useful in the contraction of lightning arresters. This is followed by an article by WURTZ in which he gives the results of a number of different ex-

periments, following Skinner's suggestion regarding lightning arresters; n some of these lead pencil marks were made on the side of the ground glass plate opposite the tinfoil, which greatly increased the length of he spark; in another it was determined whether it would be possible to prevent a dynamo current from following the static discharge over the glass plate; the terminals on the glass plate were made of blocks formed of the lower block of a non-arcing railway lightning arrester cut in two, the object being to suppress the formation of metallic vapors at the electrodes, which are necessary for the maintenance of a dynamo arc; he found that there was a decided difference in the tendency for the dynamo current to follow the discharge when these blocks are used and when they are not used. He suggests a theory based on the fact that a spark must perform a certain amount of work; the experiments showed that less work will be done over a surface than through the air; the molecules of air are in more intimate contact with each other than with the molecules of a surface; a streak of plumbago formed something of the nature of an electric crack through the dielectric; the presence of the metallic coating on the other side of the plate causes repulsion on the opposite side, and the air there is therefore less dense, a spark, therefore, does less work in passing through it. A high-potential lightning arrester has been constructed on these principles, and, although not yet tested in actual practice, the indications are that it will prove effective on circuits up to 30,000 volts.

Action of Röntgen Rays and Ultra-Violet Light on Electric Sparks. Sella and Majorana. *Nature;* abstracted in the *Elec. Eng.*, June 10.—The sparking distance is strongly diminished if the Röntgen rays fall on the positive electrode; this is the reverse of the phenomena discovered by Hertz, in which ultra-violet light increases the sparking distance when it falls on the negative pole; when the sparking was the same as when Röntgen rays were used, ultra-violet light acted in exactly the same way, and the passive pole was then the positive one; on diminishing the sparking distance "when the ultra-violet light has a facilitating action, we have shown with Röntgen rays would provoke the passing of a spark"; in this case the pole on which the radiation must fall is the negative; both kind of rays provoke the passing of the spark when falling on the negative electrode, if the sparking distance is below 30 millimetres, but above this both radiations act in an impeditive way when falling on the positive pole.

X-Ray Experiments. Ogden. *Sc. Amer.*, June 13.—He obtained excellent results with an ordinary Wimshurst machine with 20-inch rubber plates; the condenser should be small and the outside coatings connected with each other, the tube being connected between the terminals of the machine. He describes how tungstate of calcium may be made at less than one tenth the price at which it is sold by dealers; mix together about one ounce each of common salt, tungstate of soda and chloride of calcium, place them in a common crucible, fitted with a tin cover, and put this in a good coal fire—a kitchen fire will do—so as to bring it to a full red heat, at which it is kept for two or three hours, until the contents are fused to a clear liquid; after cooling the glass-like mass is broken up and thrown into a jar of water, in which the crystals of tungstate of calcium will settle to the bottom. With a rather poor apparatus he thinks that he has shown that the rays will produce a visible image on a sensitive plate in less than 0.001 second; about eight sparks from the machine will produce a photographic image.

X-Ray Tube Phenomena. Gifford. *Nature;* abstracted briefly in *Elec. Eng.*, June 10.—At a certain demonstration two of his tubes failed to act, the platinums in them being red hot; he afterward found that they worked very well and concludes that this shows that Röntgen rays are not given off by platinum heated above a certain temperature. He also tried re-enforcing the effect of the rays on sensitive plates, by placing a fluorescent screen next to the plate, and after trying a number of different substances which are named he finds that potassium platinocyanide and artificial scheelite alone produce the effect, the former being decidedly the better.

X-Ray Meter. Elec. Eng., June 10.—An English firm manufactures a small quadrant of aluminum constructed in concentric terraces running from 1 millimetre to 10 millimetres in thickness; by holding this between the tube and the screen the thickness of the aluminum which these rays can traverse can be seen on the screen, thus affording an easy means of comparing the intensity of the rays of different tubes.

Crookes-Tube Phenomena. Smith. *West. Elec.*, June 13.—He finds that the usual pear-shaped tube with a cathode at one end and an anode at one side, improves with use, and the quantity of gas in the tube gradually becomes less, as also the heating; one of the tubes occasionally produced a brilliant flash of fluorescence in back of the anode and the discharge seemed to take place backward from the anode against the glass; spots on the glass would fluoresce for five minutes after the current had been turned of.

Influence of Light on the Character of a Discharge. Elster and Geitel. *El'ty*, June 10.—A reprint of the translation noticed in the *Digest*, last week.

ELECTRO-CHEMISTRY AND BATTERIES.

Plating Aluminum. Margot. Lond. *Elec.*, May 29; abstracted briefly from a French journal.—The difficulty lies in overcoming the resistance of the alumina which is formed; the plate is cleaned in a warm solution of an alkaline carbonate, which makes it rough and porous, after which it is washed in running water, dipped in a hot 5 per cent. solution of hydrochloric acid, washed and dipped into a dilute acidulated solution of copper sulphate until it has received a slight coat of copper; it is then washed again, dipped once more into the copper sulphate, and a current is sent through it, after which it will take a coating of copper of any desired thickness.

Cellulose in Accumulators. Lond. *Elec. Rev.*, May 29.—In a brief discussion of Sussmann's electric miners' lamp (which is not described), it is stated editorially that cellulose, especially with weak acids, acts fairly well as an absorbent, but the effect of the acid is to convert it into grape sugar, which is decomposed by peroxide of lead, which latter is thereby converted into plumbic formiate and carbonate; in the presence of sulphuric acid sulphate of lead is the ultimate product; it is best never to allow any organic matter or any oxidizable substances to come in contact with the peroxide element of a lead battery.

Improved Leclanche Cell. L'Energie Elec., May 16.—An improvement by Aliamet consists in using an exciter made of 50 grams of salammoniac dissolved in a litre of water, to which 50 grams of glycerine have been added; this will diminish the rate of evaporation of the liquid, and will prevent the formation of creeping salts and crystals of oxychloride of zinc on the zincs.

UNITS, MEASUREMENTS AND INSTRUMENTS.

A New System of Electrodynamometers. Jacquemier. *L'Ind. Elec.*, May 25.—His object was to construct a commercial instrument without magnets, springs, or soft iron, that is, without any elements whose properties are variable; the permanency of the instrument is therefore absolute (it is dependent on gravity, however, which is not absolutely the same at different places; the error introduced is small but appreciable); the deflections, moreover, are exactly proportional to the quantities measured, thus requiring no calibration over the whole range of the scale. The general principle is shown in the form of a diagram for a balance in which the deflection of a needle is proportional to the weight; it consists simply of a few link motions and a sort of pendulum, the deflection of which is the counter-balancing force, the lengths of the links being so proportioned that the deflection is proportional to the weight; the theory is given as also the expression for the small error introduced, showing that it is negligible over a range of 56 degrees. He applies this same principle to various forms of electrical instruments which are illustrated and described, in which the electrodynamic attraction of two coils operates this same magnetism; in one form the deflected needle is brought back to zero by the moving of a pointer over a dial as in the usual forms of electrodynamometers; for a wattmeter the deflections are equally distant and for a volt and amperemeter they would increase as the squares; the deflection of the latter can, however, be made proportional by using a suitable link motion which he describes and which gives the square roots of the squares thus given proportional deflections; he uses it also in a device for a meter (there are quite a number of pivots, links and bearings in these instruments, introducing considerable friction).

Measuring High-Frequency Currents. Gaiffe and Meylan, *L'Elec.*, May 30 (with illustrations), and *L'Ind. Elec.*, May 25.—A reprint of an Academy paper in which they discuss several forms of apparatus; the first is the thermic galvanometer which was used by d'Arsonval, in which the deflection of a stretched wire is measured; with a platinum wire 0.08 mm in diameter currents from 30 to 200 milliamperes of voltages from 5 to 40 can be measured; the apparatus is graduated by means of a continuous current, and the ohmic resistance must therefore be independent of the frequency; a formula showing the error is given. The second instrument is an induction amperemeter based on the repulsion of the currents induced by the current; it consists of a stationary solenoid at the centre of which is suspended, by a fine wire, a small solid ring of aluminum with a light pointer attached to it; a current of 0.8 ampere gives a noticeable deflection, and with 2.2 amperes the disc is nearly perpendicular to the coil; they assured themselves that the deflections are independent of the frequency; the theory of the apparatus is given, and it is shown that above a frequency of 20,000 the apparatus measures the intensity which is equivalent, as regards induction, to a sinusoidal current of the same effective intensity.

Instruments for Measuring Frequency. Campbell. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, May 29; an abstract of a Physical Society paper.—He used a steel wire with a variable tension and in another case a steel spring of variable length clamped at one end; they were acted on by an electromagnet through which the current passed and the tension or length is varied until the maximum resonance is obtained; it is capable of measuring frequencies from 40 to 150. In the discussion Mr. Watson thought there would be a considerable temperature correction; Mr. Blakesley suggested that it might give the octave; Prof. S. P. Thompson suggested that it might be better to use a polarized apparatus and to make it massive to avoid the impression of forced vibrations; he had used

a telephone together with a tuning fork to measure frequencies; Mr. Enright thought the wire might break into overtones; Prof. Ayrton did not think it would respond to the octave unless the alternating current contained an overtone of that frequency; the author in reply said that the instrument responded feebly to the octave, which fact might be made use of as a check.

E. M. F. of the Clarke Cell. LIMB. *Jour. de Physique*, February; abstracted in the Lond. *Elec.*, May 29.—He determined the E.M.F. in absolute measure, independently of the units of current and resistance; a magnet was rotated inside of a long helix about an axis perpendicular both to its magnetic axis and to that of the coil; his final result was 1.4535; the number obtained by Lord Raleigh was 1.4527.

Testing for Faulty Magnet Windings. SZAPIRO. *Elek. Zeit.*, May 28.—A brief communication describing what he thinks is a surer and easier method than the one of speed described in the *Digest*, Dec. 7; he has used it in a number of cases with good results; he simply measures the voltages at each of the coils of the dynamo at the highest voltage of the dynamo; if the windings are uninjured the voltages will be about equal, whereas if one of them is faulty it will show a lower voltage at its ends; a simple voltmeter is sufficient for this test; the method will also enable one to obtain an idea of the extent of the damage and also whether the resistance of each coil remains the same for different currents; also to find out whether with different currents the relations of the voltages at different coils remains constant or whether it varies.

Measurement of High Resistance. BENECKE. *El'ty*, June 10.—A description of a method in which high resistance may be measured up to 1000 megohms with the usual Wheatstone bridge, and even with greater accuracy than obtainable by the deflection method, by simply measuring the high unknown resistance in the multiple with another suitable known resistance; first measure the known resistance, say of 100,000 ohms, then place the unknown in multiple with it and measure the combined resistance; then the value of the unknown resistance will be equal to the product of these two divided by their difference; the method can also be used instead of using ratio coils of widely differing values.

TELEGRAPHY, TELEPHONY AND SIGNALS.

New Paris-London Telephone Line. Lond. *Elec.*, May 29.—The negotiations between the two governments for a new line are approaching completion; the route will probably differ little from that of the present one; it will be used if necessary for simultaneous telegraphing and telephoning; the Paris Stock Exchange is to pay the French share of the cost.

Simultaneous Telegraphing and Telephoning. WILKE. *Elek. Zeit.*, May 28.—A brief summary of a recent paper describing the MUELLER system.

MISCELLANEOUS.

Tempering Steel. TAUXE'S *system. Rev. de L' Elec.*, April 30.—A short notice taken from the Swiss daily papers to the effect that Mr. TAUXE has invented a new electric process for making steel much harder than it can be made by the usual methods; several statements as to what tools tempered in this way will do are given, among which it is stated that a shear of the ordinary steel, tempered by the new process, will cut cold bars o the hardest and highest quality steel about 1½ inches wide and ¾ inches thick, the operation being repeated five times on the same bar; it is stated that with tools tempered in this way the metals can be worked with the same facility as wood. This is followed by a letter to that journal from the inventor in reply to an inquiry, giving some further information, which, however, is very scant, as the process is being patented; he gives the following brief explanation: Through a conducting bath, which he prepares, he passes an electric current at the moment when tempering takes place, the current for small articles being taken from Bunsen batteries; it is not a process of electric heating, but one of tempering; at the instant when the object which has been previously heated, either by electricity or by fire, is immersed the electric current "transforms the bath, which gives the new qualities to the steel"; these qualities are the increase of the hardness, accompanied by an increase of the elasticity, the latter being the more remarkable of its properties; while the steel is extremely hard and will not wear out, it has at the same time the peculiarity that it does not break nor is it notched or nicked, or in other words, it is very hard, but not brittle; the operation is simple and presents no difficulties to the workman, while the cost is only 2 per cent. greater than that of the ordinary process; he tempered a small saw intended for wood, with which he sawed, with perfect ease, iron and steel; the *Revue Scientifique* (Paris) will soon publish the results obtained; no further information is given.

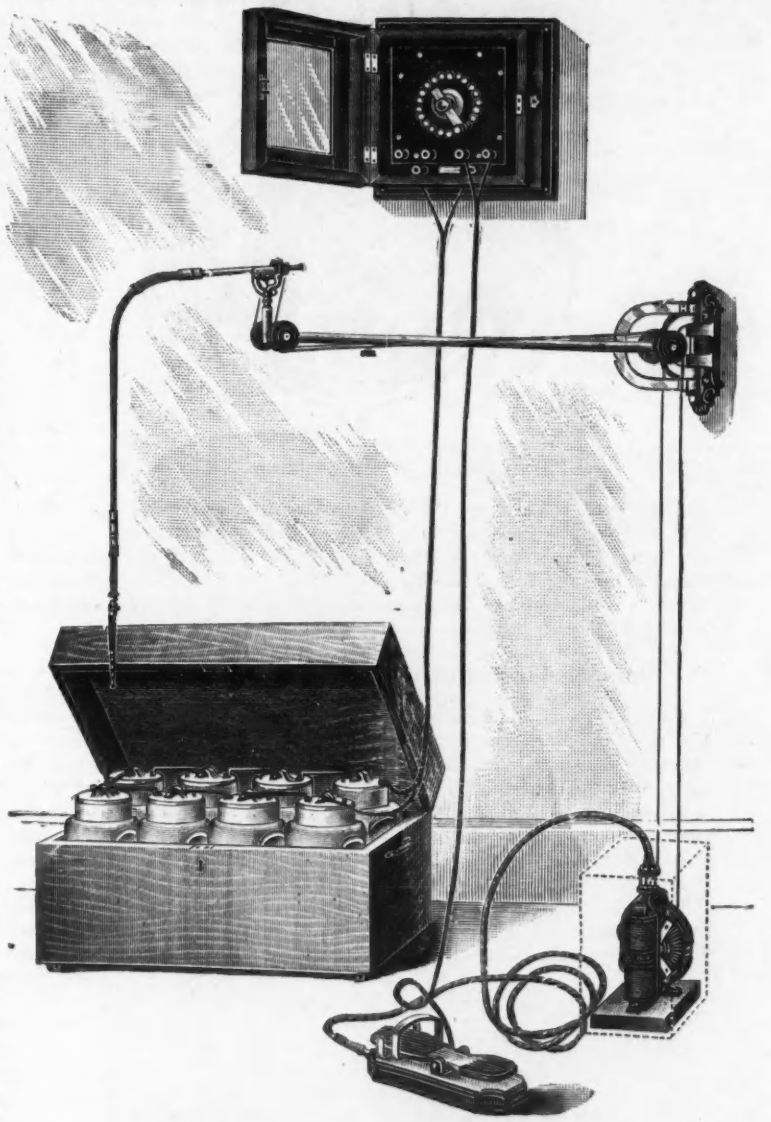
Why Progress Is by Leaps. ILES. *Pop. Sc. Mo.*, June.—An article of some length outlining an idea of the author that there is a permutative principle in evolution, a principle which he thinks accounts for the leaps of progress; the argument is illustrated by the progress of electricity; "as we trace a few of the unending interlacements of electrical science and art with other sciences and arts we shall be reminded of a series of permutations where the newest of the factors, because newest, multiplies all the factors that went before by an unexampled leap"; he endeavors to show that electricity, as a multiplier of arts and sciences, is comparable with fire.

Dental Battery Outfit.

We illustrate below a new dental battery outfit, which consists of eight cells of the well-known Edison-Lalande battery, "type "W."

The reversible motor is placed on the floor and mounted on an oak base, having a cover which fits entirely over it, to protect it from the dust, leaving only the pulley exposed. It is belted to the Gilbert adjustable arm by a round cord belt similar to that used on the foot engine. The reversing foot-switch is fitted with forward and backward movement, and also instantaneous stop attachment, when the motor is running in either direction.

The rheostat is equipped with two sets of binding posts, one of them being for the motor connection, and the other for attaching an electric



ELECTRICAL OUTFIT FOR DENTISTS.

plugger, mouth lamp, hot air syringe, or electro-cautery, as may be required, it being so constructed that it will regulate the current for all these various devices.

The Gilbert wall bracket has an adjustable movement which enables it to be raised or lowered through an angle of 30 degrees, thereby avoiding the necessity of raising or lowering the chair. It has also an extension movement of about 12 inches which can further be used as a belt tightener. The upright socket at the end of this wall bracket is of the standard size to enable any S. S. White engine head to fit into it without alteration. The engine head can therefore be removed at will from the foot engine, and attached to the electric engine without a moment's delay. The bracket is finished throughout in polished nickel, and is of handsome design. The S. S. White engine head, arm and hand-piece are employed.

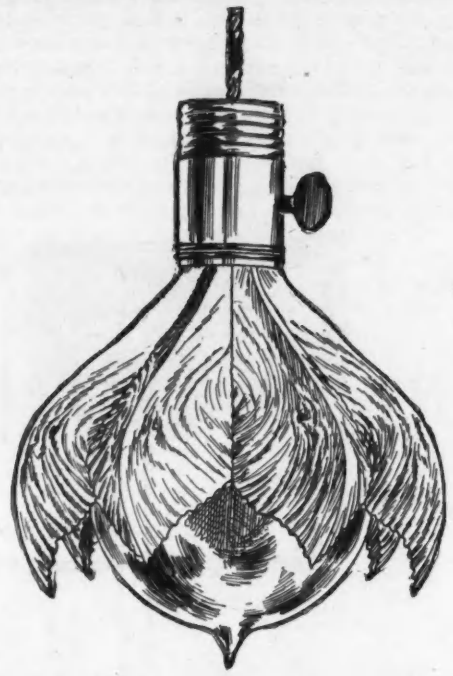
The outfit is made by the Edison Manufacturing Company, 110 East Twenty-third Street, New York City.

"The Trolley."

This is the title of a 24-sheet paper, published monthly by the Brooklyn Heights Railway Company. It is the first publication of its kind and is intended to advertise the company's special car service, as well as the pleasure resorts along the lines.

Paper Shades.

A novelty in the line of shades for incandescent lamps is shown in the accompanying illustration. These shades, which are made by A. A. McCreary, New York, are designed for temporary ornamental decoration, and for the protection of lamps from dust, dirt and flies. They are made in eight different colors, and look like porcelain lilies when on the lamp. They form an attractive feature of the lamp, with or without light. Their simplicity and cheapness will undoubtedly commend them to users of electric light.



Paper Shade for Incandescent Lamps.

Improved Induction Coils and Variable Condensers.

Messrs. Elmer G. Willyoung & Co., Philadelphia, have recently placed on the market an improved line of induction coils, which are intended to compare in quality with the best types of foreign make, but at much lower prices. Fig. 1 illustrates the new Willyoung coil, from which it will be seen that the general plan of construction, especially as regards the "hammer head" vibrator, is similar to the English Apps coils, the most famous of which was made for Mr. Spottiswood, and gave a spark in excess of 40 inches.

The iron core in each coil is of best grade Norway iron wire especially annealed, and each component wire is covered with a thin coat of shellac. The core lies inside of the primary coil and is enclosed in a hard rubber tube of sufficient length to render impossible any sparking of the secondary coil to the core or the primary coil.

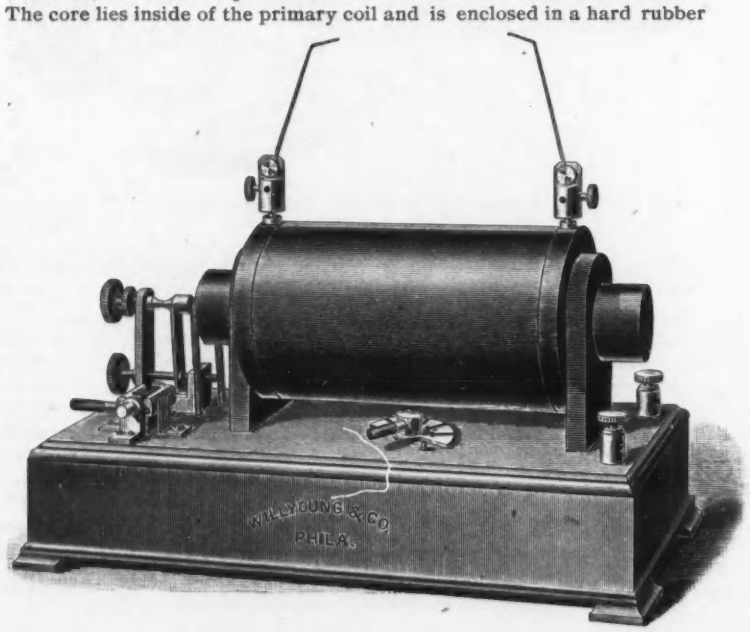


Fig. 1.

The secondary coil is wound in a large number of small sections, each insulated from its neighbors, and the coil as a whole saturated with special insulation, by an original method, in such a manner as to thoroughly exclude air, thus preventing any heating of the solid dielectric by bombardment, and consequent ultimate softening and breakdown of the insulation.

The electrical constants of these coils have been determined, it is claimed, with such care and accuracy that high efficiency is obtained, the maximum guaranteed spark being secured by a minimum amount of wire in secondary coil, and with least possible weight of the iron core. For example, in coils of 6, 8 and 10-inch spark rating, not more than one pound of No. 34 B. & S. wire is used per inch of spark length, while the discharge in each case is exceptionally solid and heavy.

A new feature stated to be of great importance and which is incorporated in these induction coils is a *variable* condenser as substitute for one of single value placed in the base of coils of ordinary design. The function of a condenser, as is well known, is to return through the primary coil the energy of self-induction produced in it at break in order to hasten the demagnetization of the iron core and thus produce a sudden rise of E. M. F. in the secondary coil. As this self-induction energy depends upon the value of the primary current in use it will be evident that a condenser of but one capacity is only suited for a particular exciting current and a particular primary spark length, without variation in either case. Even the change in electrostatic capacity produced by varying the vacuum tube (such as in Röntgen ray work), is sufficient to disturb the proper balance between self-induction and capacity. This not only reduces spark length in the secondary coil, but causes actual heating and combustion of the primary sparking points with result that repairs are probably necessary.

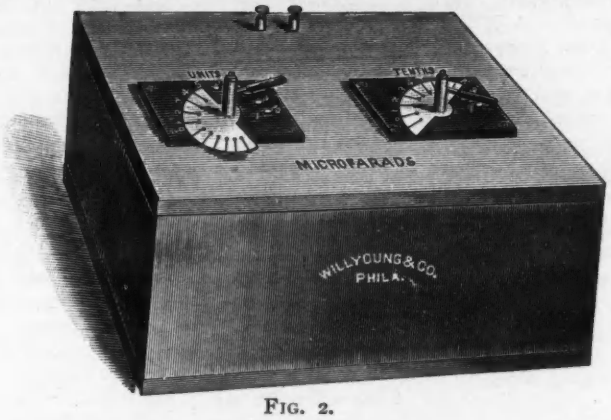


Fig. 2.

Messrs. Willyoung & Co. are also making a line of variable condensers for general experimental work—such as the study of resonance phenomena, alternating-current investigations, etc. Fig. 2 represents a 10-microfarad variable condenser with 10 sections of one tenth microfarad each and nine sections of one microfarad each.

The method of construction will meet a demand for condensers, the capacity of which can be varied much more quickly and by much finer subdivisions than is possible in the former "plug-in and plug-out" forms.

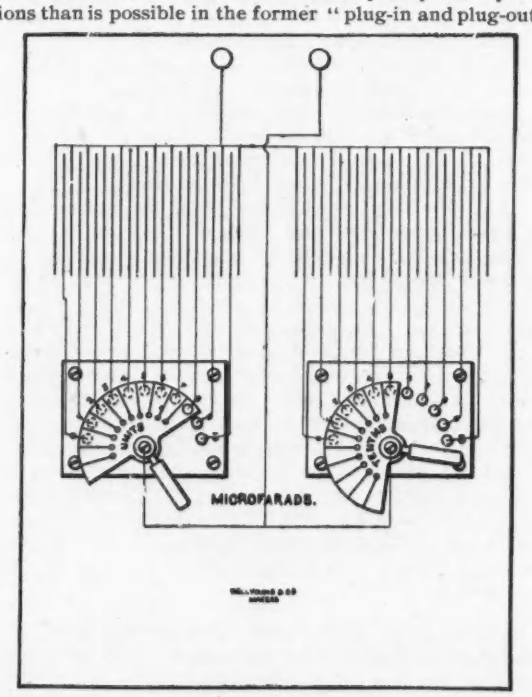


Fig. 3.

The regulating switches as shown in Fig. 3, change the condenser capacity with perfect smoothness of operation and effect.

For material of construction, tin foil and a specially selected brand of unsized paper are cut to proper dimensions and stacked together dry. These pieces are then subjected to a peculiar insulating process, by which every part is permeated with a solid dielectric. Both air and

moisture are thoroughly and permanently removed. The condensers are capable of "standing up" continuously, and without injurious heat effect on 500-volt alternating circuits, while direct currents of much greater potential can be safely employed.

All the apparatus manufactured by Messrs. Willyoung & Co. is sold through their sales agent, Mr. James G. Biddle, 944 Drexel Building, Philadelphia.

Alternating-Current Fan Motor.

This machine is of the induction type, and has neither commutator nor brushes. The one bearing is self oiling, and holds enough oil to last the season through. This one bearing makes it impossible to get out of alignment.

ALTERNATING-CURRENT FAN MOTOR.

The motor weighs but 17 pounds and carries a 12-inch fan, which runs at a speed of 2000 revolutions per minute. It is designed for frequencies of 14,000 and 16,000, and every effort has been made to decrease the self induction, which is one of the greatest losses in alternating-current motors.

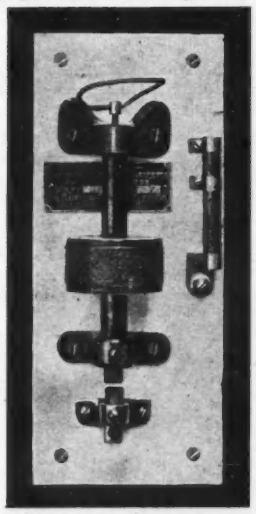
This machine differs from other induction motors on the market in having six field poles instead of eight. The magnetic circuit of each pair of poles is reduced to minimum size by careful economy of space

These machines are made by the Kent Electric Manufacturing Company, Worcester, Mass., for 104 and 52 volt currents.

Improved Lightning Arresters.

The Garton lightning arrester, which has for many years been upon the market, has been improved this season, and the Garton-Daniels Electric Company, Keokuk, Ia., claims that these instruments afford sure protection against the effects of lightning.

These arresters, we are informed, have been adopted by several of the large electric railway companies in Chicago and St. Louis after rigorous competitive tests.



RAILWAY ARRESTER.

The railway station arresters are set on white marble bases, and are 5 x 12 inches in dimensions. The car arresters are lined with asbestos and fitted with rubber bushings and flexible connecting cables, etc. It has been adopted by two large manufacturers of car motors, so we are informed.

The M. C. station arrester is of the same general design as the railway type and is made for use on 52 and 104 volt secondary, 110, 220 Edison three-wire, 500-volt power, 1000 and 2000 volt primary, two and three phase alternating and arc circuits of any voltage. At the instant of discharge it does not cause a fall of potential and consequent diminution of light.

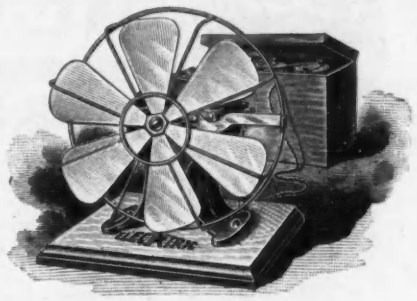
The pole arrester of this company is extensively used throughout the country for the protection of street railway and central stations, isolated plants, transformers and stationary motors on power circuits. These arresters, it is said, have given very satisfactory service. In designing these devices the Garton-Daniels Company produced an instrument that was better than the demand required, so as to be on the safe side. The result of this policy is illustrated in the increasing demand for these arresters.

Battery Fan Motor.

The Knapp Electric & Novelty Company, New York, is engaged in combat with the hot weather, in producing means to keep humanity cool. An electric fan is unquestionably a luxury in warm weather, buf it is not always convenient to tap an electric light circuit to get the necessary power to run the fan. For those who cannot avail themselves of this source of power the Knapp Company is making a line of battery fan motors that meet ordinary requirements.

The illustration shows one of these motors, which, in common with the other sizes, is well designed and made, and when run with a proper battery gives satisfaction and finds a large field of usefulness on the desk, at home, in the sick room, etc.

The company manufactures the fan outfit complete, including the battery. The cells are constant in their output of current; give off no noxious gases, and are said to be wasteless when not in actual use. They require the minimum amount of attention, which is a very important feature of a battery outfit. The battery is encased in a neat cabinet.



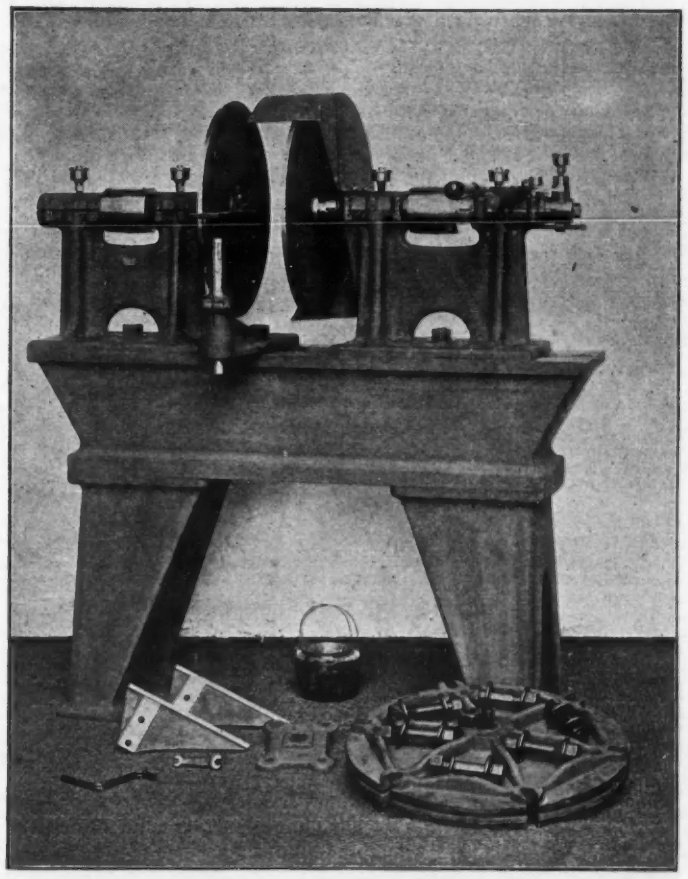
BATTERY FAN MOTOR OUTFIT.

The motors are provided with starting switches, and it is stated will run from 125 to 175 hours on one battery charge.

The motor of Type D takes four to six volts of current, and has a six-blade 10-inch fan. The smallest size motor takes one to two volts, and runs a 6-inch fan.

Improved Grinder.

The Gardner grinder is now being made by Charles H. Besly & Co., Chicago, with the two discs close together and parallel with each other. This new form is adapted to grinding two faces which are opposite and parallel to each other, such as square-headed screws, washers, spanner



GRINDER.

wrenches, etc. The work to be ground is placed between the disc wheels, one of which is movable, and is held on a rest which is between the wheels. The movable wheel is then brought up, grinding the side next to it, and also pressing the piece to be ground against the other wheel, which grinds the opposite face. The disc wheels are made from steel and are ground flat. Work can be ground true on the Gardner grinder to the ten thousandth part of an inch. The cutting faces of the wheels are emery paper or cloth, which are glued on the steel discs and securely held in place by the spiral grooves on each face of the disc. The cutting surface of the emery cloth sinks into the spiral groove, thus forming a clearance for the particles of emery and iron to fall in, so that these particles do not roll between the cutting face and the work and prevent the wheel from cutting. This feature makes the Gardner grinder a fast cutter, and with the parallel discs as many as 800 square head set screws can be ground in an hour, grinding the four sides of each head and making the opposite sides parallel.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, June 13, 1896.

TELEPHONE.—Bell Telephone showed marked strength, probably as a result of the dividends declared during the week. The closing quotations show an advance of 1½ points over last week.

GENERAL ELECTRIC showed no material change as compared with last week, the trading being about normal and the price closing at a net loss of one point. The quotations ranged from 30⅞ to 33.

TRACTIONS.—The downward movement of electric traction stocks continues and in spite of this the demand is very light. The transactions in Brooklyn Rapid Transit during the week amounted to 1672 shares, and the closing price shows a net decline of ⅞ for the week.

TELEGRAPHS.—Western Union was quiet; the trading was rather light, the quotations remaining firm, showing a net gain of ½ at the close. The highest price of the week was 86 and the lowest 84⅝, closing at 85⅞.

THE DIRECTORS of the American Bell Telephone Company have declared a regular quarterly dividend of 3 per cent. and 1½ per cent. extra.

THE EDISON ELECTRIC ILLUMINATING COMPANY, New York, reports gross earnings for May of $169,166, an increase of $13,307 as compared with the same month of last year, and net $77,751, an increase of $2605. For the five months ending May 31 the gross earnings were $946,837, an increase of $78,526 as compared with the corresponding period of last year, and net $477,120, an increase of $59,391.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Brooklyn, has declared a quarterly dividend of 1½ per cent., payable July 15.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable July 1.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	118¼	..
Edison Electric Ill., New York	100	94¼	96
" " " Brooklyn	100	99	102
" " " Boston	100	135	140
" " " Philadelphia	100	137	..
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	30½	31
Electric Storage, pref	100	32	32½
General Electric	100	32	32¼
General Electric, pref	100	73	75
Westinghouse Consolidated, com.	50	..	29½
" " pref	50	53½	..

BONDS.

Edison Electric Ill., New York	105	107	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	92½	..

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	206	206½
American District Telegraph	100	38	40
American Telegraph & Cable	100	91	93
Central & South American Telegraph	100	124	127
Commercial Cables	100	150	..
Erie Telephone	100	59	60
New England Telephone	100	91	..
Postal Telegraph-Cable	100	86	87
Western Union Telegraph	100	85¾	86

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	18	18¼
Brooklyn Rapid Transit		23⅜	23¾
Brooklyn Traction	100	..	14
" " pref	100	46	48
Buffalo St. Ry	100	65	68
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	45	47
Hestonville	100	53	54
" pref		..	62½
New Orleans Traction	100	11	14
" " pref	100	65	70
North Shore Traction	100	25	28
" " pref	100	..	77
Rochester St. Ry	..	20	25
Steinway Ry	..	45	50
Union Railway (Huckleberry)		98	105
Union Traction, rcts $10 pd	..	14⅛	14¾
West End, Boston	100	71½	..
" " pref	100	89¾	90
Worcester Traction	100	14	16
" " pref	100	88	90

BONDS.

Brooklyn Rapid Transit 5s. 1945	100	79½	..
Buffalo St. Ry. 1st con. 5s	100	105½	*107½
Cleveland Elec. Ry. 1st mtge 5s	100	100	103
*Columbus St. Ry. 1st 5s	100	93	97
Rochester St. Ry. 1st 5s	100	99½	102
Union Railway (Huckleberry) 1st mtge 5s		102½	105
*Westchester Electric 1st mtge 5s	100	100	102

* With accrued interest.

ISSUE OF BONDS.—It is stated that President Samuel Insull, of the Chicago Edison Company, is in New York to arrange for floating the $3,500,000 of new 5 per cent. gold bonds of the company.

THE EXECUTIVE COMMITTEE of the Western Union Telegraph Company has recommended the declaration of the regular quarterly dividend 1¼ per cent., payable July 15.

DIVIDENDS.—The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent., payable July 1.

THE ERIE TELEGRAPH & TELEPHONE COMPANY held a meeting of the stockholders in New York City on June 9, and ratified the action of the directors, authorizing the issue of $4,000,000 5 per cent. 30-year bonds to be secured by mortgages of shares in the capital stock of other companies owned by the Erie Company. The proceeds of these bonds will be applied to the extension of the plant.

SALE OF BONDS.—The $5,100,000 Milwaukee Electric Railway & Light Company 5 per cent. gold bonds offered simultaneously in New York and London by J. P. Morgan & Co. and J. S. Morgan & Co. last week were subscribed for mostly in London.

THE SCRANTON TRACTION RAILWAY COMPANY reports gross earnings for May of $30,762, an increase of $5762 as compared with the same month of last year, and net $16,525, an increase of $4412. For the 11 months ending May 31 the gross earnings were $301,033, an increase of $59,217 as compared with the corresponding period of last year, and net $151,166, an increase of $54,380.

BONDS LISTED.—Among the bonds listed on the New York Stock Exchange on June 11 were $4,875,000, Brooklyn Rapid Transit Company's 5 per cent. 50-year gold mortgage bonds.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, June 15, 1896.

POSTAL TELEGRAPHY.—We have received from Mr. P. B. Delany a copy of a printed document giving his argument before the United States Senate Committee on Post Offices and Post Roads regarding postal telegraphy by the machine system.

J. DAY FLACK, the well-known electrical engineer, has recently associated himself with Messrs. Burhorn & Granger, contracting electrical engineers, 136 Liberty Street, New York. Mr. Flack's thorough technical knowledge and practical experience will be a valuable acquisition to the firm.

AIR MOTOR CARS.—The Metropolitan Traction Company expects that six of the cars that have been sent to Worcester to be equipped with compressed air motors will be returned ready for trial the latter part of this month, and the other four soon afterward. A trial of the system will be made about July 1, and machinery for charging the motors is now being erected in the Lexington Avenue power-house.

MR. H. J. SMITH MORTALLY INJURED.—The many friends of Mr. H. J. Smith, superintendent of the Edison Electric Illuminating Company, of this city, will be deeply pained to learn of the serious accident that befell that gentleman last Sunday. While walking on a beam in his barn, at Washingtonville, N. J., near Plainfield, he fell 15 feet to the floor. His skull was fractured and he was injured internally. At this writing the physicians did not think that Mr. Smith would survive his injuries. Mr. Smith was president of the National Electrical Exposition Company, under whose auspices the recent exposition was held.

THE FOURTH AVENUE LINE LEASED.—The directors of the New York & Harlem Railway Company at a special meeting on June 11, authorized the lease of the Fourth Avenue horse-car line to the Metropolitan Street Railway Company. A circular has been sent out by President Cornelius Vanderbilt with a notice to the stockholders of a special meeting to be held on July 15 to ratify the lease. The terms of the lease, which is for 999 years from July 1, as related in the circular, are that the Metropolitan Street Railway Company shall pay an annual rental, exclusive of all taxes, of $350,000, equivalent to 3½ per cent. on the capital stock of this company, for the first five years, and of $400,000, equivalent to 4 per cent. on such capital, thereafter.

SEARCHLIGHT DRILLS.—Six United States warships had a searchlight drill off Tompkinsville, Staten Island, on the night of June 11. A large crowd witnessed the performance from both shores. The signal lights were flashed by the Artois system. The lights of the squadron were ordered at times to pierce the air abeam of the brilliant electric index of the *New York*; at other times they were directed to the eastward or westward in a broadside of brilliancy, and at other times they were concentrated at a point in the sky, causing an effect much like the ribbons of a giant Maypole. The vessels participating in these exercises were the *New York* (flagship), the battleship *Indiana*, and the cruisers *Columbia*, *Cincinnati*, *Newark* and *Montgomery*.

KILLED BY AN ELECTRIC SHOCK.—On Saturday night last George Collet, who kept a millinery establishment at 243 Grand Street, this city, was

almost instantly killed by an electric shock while attempting to make an arc light in front of his store burn properly. At 7 o'clock, when the current was turned on the circuit, Collet's light began to flare and sputter, and did not burn well. It order to get it working satisfactorily, Collet picked up a piece of picture moulding about seven feet long through which a strip of metal ran. With this stick he attempted to stir up the mechanism somewhat, when he received a shock which killed him instantly, as above noted. It is evident that the current passed though the metal strip in the picture moulding, and through his body to the ground. It is stated that the current had a pressure of 1500 volts.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., June 12, 1896.

H. F. WOODS, purchasing agent of the West End Street Railway Company, Boston, offers for sale a number of G.-E -multipolar 500-kw generators, all of which are in first-class condition.

THE NEW ENGLAND ELECTRIC SUPPLY COMPANY, Boston, is now carrying a full and complete line of the well-known specialties of the Perkins Electric Switch & Manufacturing Company, Hartford, Conn.

MR. F. B. SMITH, who until recently was Boston manager of the Perkins Electric Switch & Manufacturing Company, Hartford, Conn., has accepted an important position with the Suffolk Electric Manufacturing Company, Boston.

MR. H. D. STANLEY, who is now identified with W. R. Brixey, manufacturer of Day's Kerite wire specialties, was a Boston visitor this week and his presence brought to memory again "old times." Mr. Stanley has hosts of friends in Boston, all of whom have good reason to kindly remember and appreciate him and whom he is sure to include in the already large list of friends of Mr. Brixey and his wire manufactures.

MR. H. H. HUNT, 202 Equitable Building, Boston, reports an excellent and increasing business in bearings for street-car motors. He is selling agent for the J. F. Newell Company, Gardner, Me., whose goods have earned an enviable reputation for accuracy and wearing qualities. This company is now adding a foundry to its plant and with latest improvements and increased facilities hopes to be able to keep abreast of its orders. Mr. Hunt also handles a general line of electrical and street railway goods.

THE NEAL ELECTRIC HEADLIGHT COMPANY, 8 Oliver Street, Boston, has been recently incorporated under the laws of Massachusetts. F. E. Huntress is its president, Geo. M. Towle, vice-president, and Geo. C. Ewing, secretary. The company will continue to push the Neal electric headlight, which has commanded liberal adoption among street railways, and will handle generally railway supplies of all character, and also act as a contractor of street railways. The officers of the company are well-known and popular.

MR. F. W. BRADLEY, steam and electrical supplies, 202 Equitable Building, Boston, represents an excellent line of specialties, and is building up a nice business. Among his principal specialties are Habirshaw wires and Wirt dynamo brushes, and he represents the Viscosity Oil Company, Chicago, and the Fletcher Manufacturing Company, Dayton, O. Mr. Bradley is something of a veteran in the electrical business, most of his career having been spent in the West where he held important connections, and his progressive energy will unquestionably bring him success in the New England field.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
927 Chestnut Street,
PHILADELPHIA, Pa., June 12, 1896.

THE PENN TELEPHONE COMPANY, N. Bassett & Son, formerly of 30 South Broad Street, Philadelphia, Pa., have moved their place of business into larger and more commodious quarters at 114 North Sixth Street, that city.

THE NEWTON MACHINE TOOLS WORKS, Twenty-fourth and Vine Streets, Philadelphia, Pa., have received a large order from the New Russian locomotive works, included in which are many heavy milling machines, cold saw cutting-off machines, boring machines, etc.

A. WHITNEY & SONS' TROUBLES.—It is thought that part, if not all, of the works of A. Whitney & Sons, car wheel manufacturers, Philadelphia, will be shut down as a result of the executions issued against the firm by Burnham, Williams & Co., for $46,128. A. Whitney & Sons assigned recently, and while Burnham, Williams & Co. were disposed to give the unfortunate firm a chance to pull through, it was seen of late that this could not be done, hence the judgment.

THE KEELER & HANSELL COMPANY has moved its office from this city to its factory, 166 Elm Street, New York. This change was made on account of the necessity for concentrated attention at the factory. The company has been running on full time for the past six months and has enough orders on its book to keep it busy for the next six months. The company is enlarging its plant and is now in a better position to fill orders with greater promptness.

WASHINGTON NOTES.

WASHINGTON, D. C., June 12, 1896.

BATTERY MATERIAL FREE OF DUTY.—The new Guatemala tariff admits free of duty carbons for galvanic batteries and their extra parts (with the exception of salts and acids used with them), of any system or make. This went into effect March 15.

FINED.—In the case of Augustus P. Crenshaw, superintendent of the Chesapeake & Potomac Telephone Company, charged with occupying the public space for private purposes, in the stringing of a telephone wire near the power house of the Metropolitan Eelectric Railway, the District contended that a wire was removed from one street to the other, while the company claimed that they merely removed an old wire and substituted a new one. The judge said the law had been violated and imposed a fine of $25. Counsel made a motion for a new trial.

THE GRADUATING CLASS of the Bliss School of Electricity at Washington made a trip about the city on specially electrically lighted trolley cars on the night of June 11. The cars were decorated by the students themselves with unique devices, and along the sides were the words, "Bliss School of Electricity." The party made four round trips, and on the return the current gave out when they were in front of an ice cream saloon. A new supply of energy was taken aboard in the shape of ice cream and cake, after which the cars ran without any hitch. The programme included a band of music, which played at frequent intervals. The affair was a great success and greatly enjoyed by all who participated.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., June 12, 1896.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is meeting with considerable success in the use of Packard Mogul lamps for lighting parks and Summer gardens. One of Chicago's largest pleasure resorts of this kind, Fisher's Garden, near Lincoln Park, has been lighted entirely with the Packard Mogul lamps for two seasons with such success that the Electric Appliance Company is making special efforts to extend the use of these lamps for this class of work.

RAILWAY COMPANY AND STREET CLEANING.—The Colorado Supreme Court recently handed down a decision in the case of the City of Denver against the Denver City Cable Railway Company, a suit instituted to recover for alleged violation of a city ordinance. The company was charged with "maintaining certain unclean and filthy drains and syphons under its railway tracks and at street intersections," and thereby endangering public health. In the trial court a decision in favor of the company was handed down, as it was held that the corporation could not be compelled to do the work of the Municipal street cleaning and health departments. This decision is affirmed by the Supreme Court.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, June 3, 1896.

THE ENGLISH PATENT OFFICE IN 1896.—In his thirteenth report the Comptroller General of Patents states that in 1895, for the first time since 1885, the number of applications for patents shows no increase upon that of the preceding year, but on the contrary, a decrease of 321, the figure for 1895 being 25,065, only some 12,500 patents being actually granted. I may mention that 2.3 per cent. of the total applications were made by women. The balance sheet of the Patent Office is a very satisfactory one from the point of view of economical and honest administration. The receipts for 1895 amounted to £187,000 and the expenditure to a little over £100,000, leaving a surplus available for the revenue of over £86,000. The two principal items were salaries, £54,853, and printing, £24,650. A sum of over £100,000 was spent on new buildings.

ALTERNATE ARCS AND WAVE FORMS.—An interesting discussion on the influence of the alternate-current arc on the form of the alternate-current wave, has arisen out of the paper which was read a short time ago before the Physical Society by Mr. Julius Frith. Mr. Steinmetz has stated that Mr. Frith is in error in supposing that the arc always distorts the wave into a flat-topped form, and states that the kind of distortion which takes place depends upon the internal reaction of the alternator. M. Blondel now states that the phenomenon of this distortion was first observed in 1881 by Prof. Joubert, and alleges that the kind of distortion which occurs depends upon the character of the carbons used. In Mr. Frith's experiments a Wilde iron-cored alternator was used, and undoubtedly the arc distorted the wave into practically a flat-topped form. The subject, I believe, is to form the basis of further investigations, which no doubt will lead to some interesting light being thrown upon the phenomena of the alternate-current arc.

THE FIRST ANNUAL CONVENTION OF THE MUNICIPAL ELECTRICAL ASSOCIATION.—As I stated in a recent letter, the municipal electrical engineers of England have formed themselves into an association and will hold their first annual convention in London on Wednesday next. Judging by the titles of the papers, the first convention of this new association will be an exceedingly interesting one, but judging also by the short time allotted to the reading of the papers and their discussion, it is doubtful whether full justice will be done to them. On the first day, for instance, the convention meets at 10.15 in the morning, and by 1 o'clock a presidential address and four papers have to be read and discussed. Papers will be read at almost equally high pressure on the following day, and although on Friday, the concluding day, there is only one paper down for reading, there is still plenty of work, as there is to be a special meeting for the election of president, vice-president, etc., a run down to Brighton, a reception by the Electric Light Committee of the Brighton corporation, a visit of inspection to the Brighton Electricity Works and the reading and discussion of a paper.

THE UTILIZATION OF WATER POWER.—An interesting paper was read last Thursday at the Institution of Electrical Engineers by Mr. Alph. Steiger on the subject of the utilization of water power, especially of low falls. Mr. Steiger described a number of water power installations on the Continent, most of which, however, were on large falls, and the object of his paper seems to have been to advocate the utilization of English low-fall mill-sites for electrical purposes. Most of the speakers who took part in the discussion stated that, owing to the difficulties which are to be found on low falls in this country, such utilization would involve a greater initial outlay and a larger annual expenditure than with steam plants. It was the general impression that water power electric supply stations needed to be installed with stand-by steam plants, as during a considerable part of the year the turbines are unable to work, partly because of too little water, partly because of too much water, and partly because they are frozen out. In the course of his paper Mr. Steiger described the turbines which have been put up for the new aluminum works at the Falls of Foyers, in Scotland. These are partial admission impulse turbines, working on a vertical shaft under a head of 350 feet. Each turbine

develops 700 belt horse-power. There are at present five such turbines, each direct-coupled to an electric generator.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The feeling of discontent in the management of the Institution and the movement for reform has resulted in the Council of the Institution making several important suggestions in the matter of its constitution. These suggestions have been practically adopted *en bloc* at a recent special general meeting, and now only await confirmation by another special general meeting. The main object attained had been the diminution of the voting power of past presidents, which has almost invariably been exerted on behalf of conservatism, with the result that the Institution has largely lost touch with the younger and more energetic members of the electrical profession, many of whom have retired and formed themselves into smaller associations, such as the Northern Society of Electrical Engineers and the Municipal Electrical Association just mentioned. Previously there were 13 past presidents, each of whom had a vote, whilst the Council proper, including the president and vice-presidents, only had 20 votes. In future the Council proper will amount to 23, and only the immediate past president and the four senior past presidents present at any meeting of the Council will be allowed to vote. It is hoped that with this diminution of the power of the more ancient members of the profession, coupled with provisions for securing a more rapid and more regular flow of members through the Council Chamber and more ample discussion of the affairs of the Institution at the annual general meeting, the Institution of Electrical Engineers will regain the dominant position it once held.

General News.

New Incorporations.

THE TUSCARAWAS TELEPHONE COMPANY, of New Philadelphia, O., has been incorporated with a capital stock of $25,000.

THE PUEBLO ELECTRIC POWER COMPANY, Pueblo, Col., has been formed by H. Eugene Chubbuck, Irving Hale and A. E. Pattison. Capital stock, $5000.

THE ROCHESTER TELEPHONE COMPANY has been incorporated at Rochester, Minn., with a capital stock of $20,000, by Fred S. Haines, James A. Malone and C. F. Haines.

THE EAGLE ELECTRIC WORKS, PEORIA, ILL., has been incorporated by Frank Thone, Charles F. Nas, Peter J. Bourscheidt, Henry Oelkins and Charles J. Sutter. Capital stock, $5000.

THE NEW YORK RAIL INSULATION & EQUIPMENT COMPANY has been incorporated with a capital stock of $25,000. The incorporators are Lloyd S. Reber, Charles M. Myers and Willard H. Gould.

THE MANCHESTER ELECTRIC COMPANY has been formed at Manchester, N. H., by William A. Tucker, Francis Peabody, Philip L. Saltonstall, Willis C. Bancroft, Boston, Mass. Capital stock, $400,000.

THE HOUTS AUTOMATIC TELEPHONE SWITCH COMPANY, Parker, S. D., has been incorporated by W. A. Houts, F. E. Hayward, C. G. Pratt, B. W. Kumler and Vale P. Thielman. Capital stock, $500,000.

THE FRANCONIA & SUGAR HILL ELECTRIC LIGHTING COMPANY has been incorporated at Concord, N. H., with a capital stock of $200,000. The promoters are Robert Pechelt, Henry H. Clark and Seth F. Hoskins.

THE WEST SIDE LIGHTING COMPANY, Los Angeles, Cal., has been formed by E. E. Peck, E. F. Billmeyer, Los Angeles; George H. Barker, William R. Staats and Walter S. Wright, Pasadena, Cal. Capital stock, $500,000.

THE ACME ELECTRIC LAMP COMPANY has been incorporated in New York with a capital stock of $25,000 by L. A. Jackson, New York; G. D. Phillips, New Rochelle; Elbert C. Rosevelt, Pelham Manor, and C. M. Cumming, Yonkers.

THE NORFOLK GAS & ELECTRIC COMPANY, Norfolk, Va., has been incorporated with a capital stock of $25,000. The incorporators are Samuel B. Lawrence, of New York; R. A. Dobie, of Norfolk; John B. Summerfield, of New York.

THE BENWOOD & McMECHAN ELECTRIC LIGHT, HEAT & POWER COMPANY, Benwood, West Va., has been incorporated by William Hall, M. F. Deegan, J. W. McDonald and R. E. Sharp, Benwood, West Va. Capital stock, minimum $375, maximum $100,000.

THE X-RAY MANUFACTURING COMPANY has been incorporated in New York, for the purpose of dealing in electrical supplies, etc. Those interested are Cyrus O. Baker, Jr., John A. Seely, Edward F. Peck, Philip J. Bennett and Fremont Wilson. Capital stock, $10,000.

THE MILBURN ELECTRIC COMPANY, Milburn, N. J., has been incorporated with a capital stock of $100,000. The incorporators are Isaiah Smith, Walter C. Whittingham, William W. McCollum, Milburn, N. J.; Stewart Hartshorne, Short Hills, N. J., and J. Marton Roll, Springfield, N. J.

THE BANKERS ELECTRIC PROTECTIVE COMPANY has been incorporated at Chicago, Ill., for the purpose of manufacturing and selling or renting automatic electric burglar, fire and police alarms. The incorporators are A. L. Deane, J. W. Donnell and Clyde J. Coleman. Capital stock, $150,000.

THE SYRACUSE ELECTRIC MANUFACTURING COMPANY, Syracuse, N. Y., has been formed for the purpose of selling electrical and mechanical appliances and specialties. The directors are Hugh J. Brady, of Cooperstown, John Begley, of Gloversville, and Robert E. Drake, of Syracuse. Capital stock, $20,000.

THE ELECTRIC CHEMICAL METAL EXTRACTION COMPANY has been formed in Camden, N. J., for the purpose of extracting gold, silver and other metals from ores by the electro process. The incorporators are James D. Darling, William L. Martin, Henry C. French and John L. Jacobs. Capital stock, $250,000.

THE CITIZENS STREET RAILWAY COMPANY OF LACKAWANNA COUNTY has been incorporated at Harrisburg, Pa., with a capital stock of $200,000. The motive power will be electricity, and the line will be 30 miles in length. The incorporators are Charles H. Schadt, William L. Connell, Henry H. Archer, Scranton, Pa.

THE MOUNT WHITNEY TELEPHONE & POWER COMPANY, Visalia, Cal., has been formed with a capital stock of $2,000. The incorporators are: W. E. Sprott, H. F. Brey, A. M. Lumley, all of Porterville, Cal.; J. Sub Johnson, Visalia, Cal; J. M. Gilstrap, Daunt, Cal.; James Bursell, Globe, Cal., and Charles Rankin, Lindsay, Cal.

THE WESTERN ENGINEERING & ELECTRICAL COMPANY has been incorporated at Denver, Col., with a capital stock of $10,000, for the purpose of manufacturing and repairing steam, air and electric machinery, erecting telephone and electric lines, etc. Those interested are Edgar L. Brother, J Henry Niedemeyer and George Stiles, Denver, Col.

THE URBAN PNEUMATIC TRACTION COMPANY has been incorporated at Harpers Ferry, West Va., for the purpose of constructing and operating street and suburban railways. Those interested are W. H. H. Knight, L. B. Whatley, F. E. Dreher, John N. Webb, Francis Hallett, Washington, D. C. Capital stock, minimum, $500; maximum, $5,000,000.

THE CATHOSCOPE ELECTRICAL COMPANY, New York, N. Y., has been incorporated in West Virginia for the purpose of exhibiting, making and selling all kinds of electrical apparatus, machines, etc. Those interested are Meredith Dryden, Plainfield, N. J.; Frederick R. Fortmeyer, Charles A. Senior Jr., and William S. McGrath, New York City. Capital stock, minimum, $500, maximum, $500,000.

THE SOUTHERN ELECTRIC COMPANY has been formed in Richmond, Va., with a capital stock of $50,000, for the purpose of erecting plants in Richmond, Petersburg and Manchester and in Henrico and Chesterfield Counties, and to generate electricity for its own use and for sale. The incorporators are John L. Williams, Edward J. Willis, Carrol H. Nolting, Nelson Perrin, Henry L. Cabell, W. W. Henry, J. Wilcox Brown and George Whitlock.

Telegraph and Telephone.

MILAN, TENN.—Milan is to have a local telephone system.

SACRED HEART, MINN.—A telephone line is to be built from this place to Renville.

NEATSBURG, KY.—A telephone line will soon be built from this place to Casey Creek.

GADSDEN, ALA.—A complete new telephone system is now being constructed in this place.

WORTHINGTON, IA.—It is quite possible that a local telephone exchange will be built in this place.

GARNER, IA.—The Electric Telephone Company will build a line from this place to Klemme, Goodell and Bel Monde.

BELMONT, N. Y.—Belmont is to have a telephone line. All the public buildings and business places will be connected.

NEWPORT, TENN.—The East Tennessee Telephone Company has just opened its extension between Knoxville and Newport.

RATHBONVILLE, N. Y —It is rumored that a stock company is to erect a telephone line from Jasper via Hodgesville to Rathbonville.

KANSAS, MO.—The Missouri & Kansas Telephone Company has bought the property of the English-Haley Telephone Company at Nevada.

GIBSON CITY, ILL.—A 25-year franchise has been granted to C. H. Langford, of Paxton, to erect a public telephone system at Gibson City.

SOUTH OMAHA, NEB.—A bill has been introduced in the City Council to impose a tax on all telephone and telegraph poles inside the city limits.

SPRINGFIELD, ILL.—The Council has refused to grant a franchise to the American Telephone & Telegraph Company for the operation of its lines through this city.

BELLEVUE, O.—The committee of the Council appointed to investigate the matter of telephone franchises reported in favor of granting a franchise to D. Calhoun of this city.

JACKSONVILLE, FLA.—A live trolley or electric light wire became crossed with some telephone wires a few days ago, setting fire to the telephone switchboard and burning out nearly 50 telephones.

SHELDON, IOWA.—The Electric Telephone Company is building a telephone line from Everly to Sioux Falls, taking in the towns on the road. It has completed the line five miles west of Hartley.

NEW PORTLAND, ME.—The New Portland & Farmington Telephone Company has been organized for the purpose of constructing and operating a telephone line from New Portland to Farmington.

TUNKHANNOCK, PA.—A company has been organized for the purpose of extending a telephone line from Tunkhannock to Centremoreland, and material has already been procured for its construction.

GALESBURG, ILL.—The Union Telephone Company is preparing to build a metallic circuit line from here to Galva. The line will connect Galva with long-distance toll lines through the central office here.

MT. GILEAD, O.—The People's Telephone Company has been granted a franchise for exchanges in Mt. Gilead, Edison and Cardington, and is extending its lines in the direction of Cleveland and Columbus.

CRESTON, IA.—Telephone companies are being organized by the citizens of Walker, Troy Mills, Paris, Coggon, Central City, Manchester, Prairieburg and other places. The lines will probably be extended to this city.

ALTOONA, PA.—A system of automatic illumination has been adopted for use in the various city fire houses. The arrangement is such that when an

alarm is sent in, all the electric lights in the building are turned on automatically. The system has proved very satisfactory.

KASSON, MINN.—The wires for the Long Distance Telephone Company were strung through this place along the line of the Northwestern Railway with a branch running over to Mantorville. This will give Kasson direct telephonic connection with all the business houses in the Twin Cities and also with La Crosse and Winona.

SNOW HILL, MD.—A company has been formed here for the construction of a telephone line connecting Berlin, Snow Hill and Pocomoke City. The company is composed of George S. Payne, J. Edward White, Irving T. Mathews, John P. Moore, and Dr. W. D. Straughn. The company will apply to the City Council at once for a franchise.

CABLE CONFERENCE.—The Pacific Cable conference was opened in London on June 5. The Rt. Hon. Joseph Chamberlain, Secretary of State for the Colonies, made the opening address, after which the general question of the desirability of a submarine cable across the Pacific Ocean was considered. After two days session the conference was adjourned for three weeks, in order to allow some of the delegates to attend the International Telegraphic Conference in Budapest.

ELECTRIC LIGHT AND POWER.

LAURENS, S. C.—At the election, the city voted $30,000 in 6 per cent. bonds for electric light and water works.

UNION, S. C.—Union is to have an electric light plant and water works, $40,000 having been voted for the purpose.

NEWARK, O.—The purchase of another 50-light dynamo for the use of the municipal electric light plant has been recommended.

OVID, N. Y.—Morgan W. La Boyteaux and his corps of workman are building the power-house for the new electric light plant in this place.

CHAMPAIGN, ILL.—Champaign has sold its electric light plant to the Urbana & Champaign Electric Light & Power Company for $3200.

BALTIMORE, MD.—The Mt. Washington Electric Light & Power Company has extended its line to Towson for the purpose of house lighting.

DALTON, MASS.—A company has been organized in this place to build an electric light plant. Mr. W. L. Tower is one of the active promoters.

WOODVILLE, O.—On the question of issuing the bonds of the village of Woodville, the town voted $10,000 to construct an electric light plant

WOBURN, MASS.—The Woburn electric light plant and business has been turned over by the receivers to the new company recently organized.

NORWAY, ME.—The Norway Light & Power Company will build an addition to its plant to make room for a new 200-kw three-phase generator.

NIAGARA FALLS, N. Y.—The Pittsburg Reduction Company is doubling the capacity of its present plant. Four thousand electric horse-power will be used.

BOSTON, MASS.—The tax assessed upon the gas and electric light companies to defray the expenses of the State Gas Commission last year was $12,149.46.

WHITEHALL, MICH.—The proposition to bond the village for $5000 for an electric light plant did not receive the necessary two thirds of the votes, therefore it was lost.

WHITEHAVEN, PA.—On May 18 the Whitehaven Electric Light Company's station was destroyed by fire, entailing a loss of about $5000. There was no insurance.

MANKATO, MINN.—The City Council was recently served with papers enjoining them from further increasing the city debt by contracting for an electric light plant.

PHILADELPHIA, PA.—The Councils have elected Mr. Harry C. Francis to represent them in the Board of Experts to submit estimates of the cost of a municipal electric lighting plant.

BORDENTOWN, N. J.—The Bordentown Electric Light & Power Company will extend its wires to Fields Borough, the Common Council of that place having granted the necessary consent.

CHESTER, PA.—The franchise of the Bacon Electric Light Company, of this place, has been signed by the Mayor, and arrangements are now being made for the erection of the new plant.

ST. PETERSBURG, FLA.—The City Council has granted a franchise to the West Coast Development Company for an electric light plant, also making the company an offer for lighting the city.

LEWISTON, ILL.—The electric light company of this place has offered to furnish the city 30 2000-cp arc lights for $60 each per year, if used till midnight, or $70 each per year for all-night lights.

ATHENS, MICH.—Athens capitalists have contracted with Rheubottom & Bond, of Union City, Mich., for an electric lighting plant, to be in operation in 70 days. The service is to be an all-night one.

BRIDGETON, N. J.—The Mayor and Common Council of Millville have been served with a writ restraining them from opening or considering bids for the construction of a new electric light plant.

MILWAUKEE, WIS.—The Common Council will undoubtedly adopt the recommendations of the committee and initiate at once the plans for the construction and operation of a municipal electric-lighting plant.

LANSINGBURG, N. Y.—An investigation will be made into the candle-power of the electric lights of this place, many of the prominent residents objecting to paying for 2000-cp lights when only 1200 are received.

NEW YORK, N. Y.—The committee in charge of the Statue of Liberty will make an effort to induce the Lighthouse Department to light the electric lamps inside the statue. The cost of this is estimated at about $1000 a year.

ROCK RAPIDS, S. D.—Rock Rapids has awarded the $9,000 of electric light bonds to Farson, Leach & Co., of Chicago, at a bid of par, plus a premium of $10 and accrued interest since May 1. The bonds bear five per cent. interest.

MEDINA, N. Y.—An agreement has been reached between the village council and the Electric Light Company, whereby the company agrees to enter into a five-year contract to furnish lights at the old terms of $60 per light per year.

RIVERSIDE, CAL.—The plans and specifications for an electric power station submitted by A. C. Willard were adopted by the City Trustees and the clerk was instructed to advertise for bids for the construction of the building.

SHERWOOD, MICH.—The Village Council has granted a franchise for 15 years to Rheubottom & Bond, of Union City, Mich, for the installation of a complete electrical lighting and power plant; the service is to be an all-night one.

NEW HAVEN, CONN.—The Board of Aldermen has authorized the Lamp Committee to make a contract with the electric light and gas companies for a period of three years. The price to be paid per electric lamp is $98.55 per year.

ATLANTIC HIGHLANDS, N. J.—George H. Stout, Jr. will construct an electric light plant here. The capacity of the plant will be 80 arc and 1000 incandescent lamps. The contract price is $14,700, and the work is to be completed by July 15.

SANTA ANA, CAL.—At the meeting of the Council, the Committee on Electric Lights submitted the estimate of E. C. Sharpe, as to the cost of the proposed municipal lighting plant. The plant will cost complete, set up and started, $28,000, including cost of building.

McLEENSBORO, IA.—The Mayor has appointed a special committee to make full investigation as to the cost and practicability of erecting, establishing and maintaining an electric light plant in this city. The committee consists of J. E. Robinson, T. B. Stelle and T. B. Allen.

SOMERVILLE, N. J.—A severe electrical storm passed over the Raritan Valley on the night of June 9, and several buildings on farms in this vicinity were struck and destroyed by the consequent fire. The electric light circuits were shut off for safety and the town was left in darkness.

CELINA, O.—City Solicitor R. L. Mattingly at a meeting of the Town Council, introduced a resolution to the effect that immediate steps be taken to secure an electric light plant for Celina. It seems to be the unanimous opinion of the public that the issuance of bonds for the purpose will be carried.

NEW YORK, N. Y.—The Portland and New York boats *Manhattan* and *Cottage City* are to be equipped with electric lighting plants by the Belknap Motor Company. A 300-light motor of 35-hp has been set up in the engine room of each boat, in which 285 lights and a searchlight have been placed.

DECATUR, ILL.—The municipal electric light and power plant has been seized by the sheriff on judgment executions amounting to about $13,000. The application for a receiver for the property will be granted. The plant it is stated is involved to the extent of $40,000, while it is valued at $75,000.

WEST RUTLAND, VT.—At a meeting held to vote on the electric light question, the contract for lighting the streets by electricity was awarded to the Vermont Marble Company for a term of five years. The company agrees to furnish 27 lights for five years at $1900 a year and to furnish additional lights at the same proportion.

COLUMBUS, O.—The bids for the erection of a boiler and power house have been opened and it is probable that the contract for the work will be awarded to Fred Fornoff at his bid of $17,839.82 exclusive of the conveyor. The bid of the Jeffrey Manufacturing Company for the conveyor was $3190.74, and this will likely be accepted, making a total cost of $21,030.56.

PITTSBURG, PA.—The Allegheny County Light Company has offered to furnish power for the operation of the electric fountain at Schenley Park free of charge. The offer was accepted. It requires 15 8000-cp lamps to operate the fountain and as a display of an hour's duration will take place twice or three times a week during the Summer, it will be seen that the electricity used is quite an item.

ROCKAWAY BEACH, N. Y.—Philip J. Bennett, receiver of the Rockaway Beach Electric Light Company, has made a proposition to light the Beach at a cost of $110 per lamp. John N. Williamson, an electrician, offered to run the lights for $100 per lamp and would submit himself to a penalty of $1000 for failure to fulfill his contract. Mr. Williamson's proposition will receive due consideration.

RUTHERFORD, N. J.—The bill of the Rutherford, Boiling Springs & Carlstadt Electric Light Company, amounting to $1,968.08, came before the Borough Council, and the Lamp Committee after examining the contract, recommended deductions of $1,088.80 for lights out, etc., and a warrant was ordered to be drawn for the bill less that amount. The company contends that the deductions are excessive.

ALBANY, N. Y.—The passage of the electric light ordinance will reduce the price of electric lighting 5½ cents per light which for 600 lights will amount to $12,045 a year. In addition to this saving, the city will obtain, free of cost, the lighting of the City Building and the City Hall, and the elevators in those buildings will be run by electricity, thus saving the salary of the engineers, making a net gain to the city of about $15,045 a year.

McKEESPORT, PA.—Bids have been received for the construction of a municipal electric light plant in this city, and they will be presented to the Council for decisive action. It is thought that a municipal plant will effect a saving of at least $5000 a year to the city. The only bid for the complete plant was made by the Fort Wayne Electric Corporation, whose estimate was $27,000, including 200 arc lamps and the necessary number of incandescents for the city buildings.

NEW ORLEANS, LA.—The New Orleans Traction Company has filed answer in the Circuit Court to the petition of the receivers of the Louisiana Electric Company asking to be relieved of the contract with that company. The old contract calls for the payment of 1¼ cents per car-mile for power, while the receivers of the Louisiana Company wish to charge 2¼ cents per kilowatt, which the Traction Company claims would amount to an increase of 100 per cent. over the contract rate. The court decreed that the receivers continue to furnish power pending the hearing and until final decree shall have been entered, at the same rate of compensation as heretofore.

The Electric Railway.

ROCHESTER, N. Y.—At the meeting of the directors of the Rochester Railway Company it was decided to re-lay the rails of the company on West Avenue.

STAUNTON, VA.—The City Street Car Company will issue $50,000 in bond to construct its trolley line, to be about six miles long. R. D. Apperson is manager.

UTICA, N. Y.—The Utica Suburban Railway Company has made application for an extension of its line from Whitesboro to a point half a mile from Oriskany.

BALTIMORE, MD.—The application of the Traction Company for a permit to erect trolley poles along the route of the Druid Hill Avenue Cable Line has been granted.

READING, PA.—G. S. W. Brubaker has been awarded the contract for the extension of the Reading & Southwestern Street Railway in Reading to Mineral Springs Park.

BALTIMORE, MD.—The City Council Committee on Railways decided to give to the Central Railway Company the franchises asked by it in East and Northeast Baltimore.

PENSACOLA, FLA.—A Baltimore syndicate has secured a franchise to build an electric road in Pensacola. W. H. Bosley, Fayette and North Streets, Baltimore, Md , is interested.

BROOKLYN, N. Y.—It is stated that the General Electric Company has brought suit against the Nassau Electric Railway Company for infringement of certain trolley patents.

LEWISTON, N. Y.—Messrs. Crage & Tench have been awarded the contract for the construction of the Lewiston & Youngstown Frontier Railway, work upon which will be commenced at once.

BALTIMORE, MD.—During a storm on June 9, lighting struck the powerhouse of the Chesapeake Electric & Water Company at Herring Run. An incandescent dynamo was completely destroyed.

MACON, GA.—The Macon & Birmingham Railway Company was organized. F. M. Edwards, of Boston, is president; E. C. Parsons, of Boston, secretary, and Julian R. Lane, Macon, general manager.

CATSKILL, N. Y.—A trolley road is to be built from Catskill to Windham, a distance of 25 miles, and will open a most attractive country, bringing in touch Leeds, Cairo and Durham, all popular resorts.

CAPE ELIZABETH, ME.—The Selectmen of this town received a petition from the Portland & Cape Elizabeth Electric Railway Company for permission to extend its tracks along the shore road to Pond Cove.

COLUMBIA, S. C.—The Board of County Commissioners granted to the Street Railway Company the right of way to build the Columbia & Eau Claire line up the Monticello road to Marstellar's Spring.

ONEIDA, N. Y.—The State Board of Railroad Commissioners has granted the application for permission to the Chittenango & White Sulphur Springs Company to build a new electric road in Madison County.

BROOKLYN, N. Y.—The Brooklyn City & Newtown Railroad Company has been fined $25 and costs of trial for violating the speed ordinance. The company will appeal, on the ground that the ordinance is illegal.

NEW BRITAIN, CONN.—The Central Railway & Electric Company will be granted a hearing on its petition to change their route to connect with the tracks of the Newington Tramway Company at the eastern town line.

PORT JEFFERSON, L. I.—The Patchogue & Port Jefferson Traction Company has been granted the right by the State Railroad Commissioners to build a trolley line across Long Island to connect this place with Patchogue.

BROOKLYN, N. Y.—President Albert L. Johnson, of the Nassau Electric Railway Company, states that the motorman of car No. 719, which ran away on the Thirty-ninth Street hill last Sunday, was responsible for the accident.

PITTSBURG, PA.—The Consolidated Traction Company has secured a site in the East End for its new buildings. The price paid for the ground was $90,000. Offices, shops, car barns, repair and paint shops will be erected on the property.

BROOKLYN, N. Y.—It is reported that street railway officials in New York and Brooklyn, as well as capitalists, are earnestly considering the project of constructing a tunnel between the two cities, under the East River, for the passage of surface railway cars.

PITTSBURG, PA.—One of the new Westinghouse-Baldwin electric locomotives was tested at Wilmerding a few days ago, under conditions, which, it is stated, indicate that a speed of 80 or 90 miles an hour can easily be attained under favorable circumstances.

MILWAUKEE, WIS.—The City Council has passed the four-cent fare ordinance. Thirty days' time is given the street railway company to print commutation tickets and make arrangements for carrying out the terms of the ordinance. The railway company will carry the matter to the courts.

CHESTER, PA.—The time has expired for the building of the two trolley roads which were to run through the village of Upland. The franchises were granted at the urgent request of the companies, namly, the People's and the Media, Middletown, Aston & Chester, but no effort to get the work started is apparent as yet.

FORT WAYNE, IND.—New Haven, a suburb six miles east of this city, will soon be connected by an electric railway. Alexander B. White has secured the right of way for the entire route, and within a few weeks will be granted a franchise, and work will be commenced immediately, so that the line may be completed this Summer.

BOSTON, PA.—The extension of the Second Avenue Traction Electric Railway lines from Boston, Pa., to Suterville, West Newton, Mendon, Ruffsdale, Tarr, Mt. Pleasant, and Scottdale is now assured, The right of way has been secured and the cars will be running by Fall to West Newton. The company is now negotiating for the right of way from West Newton to Mt. Pleasant.

YOUNGSTOWN, O.—At a meeting of the Common Council recently considerable discussion was created by the announcement of the fact that the Youngstown Street Railway Company was about to abandon its Mahoning Avenue line. An attempt was made to declare all the company's franchises in the city forfeited. A special meeting will be held to decide the matter.

BALTIMORE, MD.—The Council Committee on City Passenger Railroads visited Washington recently and investigated the underground conduit system in operation there. The object of the visit was to enable the committee to act intelligently on the proposed ordinance authorizing the construction of an underground system by the Metropolitan Railway Company in Baltimore.

NEW YORK, N. Y.—The directors of the Third Avenue Railway Company are desirous of building an extension of the Amsterdam Avenue line from 162d Street through Kingsbridge Road to the city limits as soon as possible. The Manhattan Elevated Railroad Company also proposes to run its line through this street if the Rapid Transit Commissioners grant the request for certain extensions.

IPSWICH, MASS.—It has been rumored that the G. & B. Electric Railroad Company had purchased the franchise of the Essex County Company, and that the road would be continued from Ipswich to Haverhill, by the way of Georgetown and Rowley this season. It is the road that will connect Cape Ann, Ipswich, Beverly and Salem with Haverhill, Lawrence and the upper section of the county.

BROOKLYN, N. Y.—Regarding the alleged recklessness of motormen in speeding their cars, President A. L. Johnson, of the Nassau line, states that 15 men have been discharged within 60 days for offences of this character. The officials of the railway company are doing everything in their power to stop fast running, and issue orders every few days, or whenever they learn that the motormen and conductors are not obeying the rules.

VICTORIA, B. C.—The coroner's jury which investigated the recent bridge disaster, on June 13, rendered a verdict holding the Consolidated Railroad Company's directors responsible for the loss of 55 lives. The City Council was also arraigned as guilty of contributory negligence, but the officials of the corporation were absolved of personal responsibility. The jury found that the bridge was safe for ordinary traffic, and the accident would not have occured but for the improper crowding of the car which went through the structure. They also found that the bridge was not constructed according to the original specifications.

MILWAUKEE, WIS —The strike of the street railway employees is still on and in the suburbs rioting has been resorted to in order to prevent the running of the cars. Formal notice was served on the sheriff of Milwaukee County by the electric railway company that he must protect the company's suburban lines and the men who are employed there, and if unable to do so a call must be made on the Governor to order out the troops. As a result of this notification, Sheriff Stanley took a force of 50 deputy sheriffs to Silver City, where the riots occurred, and lined the street railway tracks with officers. Cars were run on that line during the night without disturbance for the first time in five weeks. Three men have been shot while aboard cars, one of whom is expected to die. The company has offered a reward of $2000 for the arrest and conviction of the persons who shot the conductor and motorman on June 4.

Trade and Industrial Notes.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., has just issued a neatly illustrated monthly calander. The illustrations show Goulds pumps of various types.

THE F. P. LITTLE ELECTRICAL CONSTRUCTION & SUPPLY COMPANY, Buffalo, N. Y , is the agent for the lighting apparatus and supplies in Erie County for the General Electric Company.

THE JEFFREY MANUFACTURING COMPANY, Columbus, O., describes and illustrates in a very effective manner in a neat catalogue its labor-saving appliances for mills, factories, industrial and power plants.

THE E. & C. ELECTRIC COMPANY, Cleveland, O., has just issued illustrated circulars 1, 2 and 3, descriptive of its multipolar generators and motors of all sizes and for all purposes. These machines are fully described.

H. B. COHO & CO., New York, have just issued an illustrated price list of the various electric generators, motors, transformers, measuring instruments, etc., dealt in by them. Their trade is extensive and remarkable for its variety.

THE LAKON COMPANY, Elkhart, Ind., has recently shipped to Redondo, Cal., a complete equipment of transformers for a new plant. The order was procured through the California agent, the Electrical Supply Company, Los Angeles, Cal.

KEEP COOL.—The American Blower Company, Detroit, Mich., is making a full line of disc ventilating fans, which are operated by direct-connected steam engines for electric motors. The company has just issued a little pamphlet descriptive of its apparatus.

MOTOR VEHICLES.—Mr. Charles H. Barrows, Willimantic, Conn., has perfected his motor carriage. It is stated that the whole operation of driving, stopping, starting and steering is so easy and simple that a child can manage it with ease. The vehicle is preferably operated by electric power, although it may be propelled by any other form of power.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has a contract for furnishing steel trusses for the new building which is to be erected by the Holyoke Gas Company, of Holyoke, Mass. The building is 50 feet wide and 60 feet long. Roof trusses are entirely of steel, and the covering is slate. No woodwork or inflammable material will be used anywhere in the construction.

EUGENE MUNSELL & CO., miners and importers of mica, New York and Chicago, are enjoying an excellent trade in India mica, of which they make a specialty, being direct importers from the mines, and employing a large force in selecting the mica. They are in a position to furnish it cut to size and stamped to any shape or pattern for electrical insulation. They have just issued a neat price list, which is being mailed to the trade, and offer to send samples and quotations to the electrical trade on application.

THE PIONEER ARC LAMP.—The enclosed arc long-hour lamp, of which Prof. Louis B. Marks was one of the early exponents, is said to be rapidly growing in favor. Prof. Marks did not wish to waste his little funds in law suits, so he secured a very strong backing of capitalists, who, he states, have pledged $2,000,000 for his enterprise, while after this fact became known, offers of between $7,000,000 and $8,000,000 more have been received at his office. The offices and show rooms of the Electric Arc Light Company, at 687 and 689 Broadway, are attractively laid out, while the laboratory at 250 and 252 Mercer Street is a model in its way.

MR. L. W. KINGSLEY, secretary of the Mica Insulator Company, New York, sailed on June 3, on the steamship *St. Louis* for a trip abroad, where he will spend a considerable time in sightseeing, as well as looking after the affairs of the company in Europe. The company's business is largely increasing in foreign countries, which is due to the high grade of insulation "Micanite" they are furnishing the manufacturers of electrical machinery of the European countries at their newly-equipped factory, which is located at Stoke Newington, London. Upward of 100 hands are given employment here. The company's London office is at 12 Camomile Street,

Business Notices.

The illustrations in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street. Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 8, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

561,448. MAGNETIC MEDICAL APPARATUS; A. B. Slater and N. A. Renstrom, Omaha, Neb. App. filed Oct. 9, 1894. A magnetic medical apparatus comprising a support for a body, and electromagnets distributed beneath the surface of the support so as to create a magnetic field therein. (Omitted last week.)

561,560. ELECTRIC ARC LAMP; S. Bergmann, New York, N. Y. App. filed Feb. 27, 1895. The combination of a movable carbon support, a clutch for co-acting with the support, a pivoted frame provided with arms on each side of the carbon support which are adapted to impinge against the clutch and cause its engagement with the support, a stop-piece also adapted to impinge against the clutch and cause its disengagement from the support, and a shunt electromagnet for moving the pivoted frame.

561,565. AUTOMATIC ELECTRICAL BATTERY CUT-OUT; H. W. Clelland and F. J. Madden, Wilkinsburg, Pa. App. filed Dec. 11, 1895. In an automatic electrical annunciator and cut-off, a battery or series of batteries suitably connected by wires to binding-posts arranged in any suitable manner, said batteries carrying a float having an upright rod secured thereto, said rod being slotted and provided with an adjustable arm having a hook portion and a wire connecting an auxiliary battery to a bell.

561,581. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed Nov. 29, 1895. In combination in an electric switch, a base bearing a stationary pole adapted to be connected with one of the circuit wires, a lever pivoted to the base so that one end will swing into and out of contact with the stationary pole and adapted to be connected with the other of the circuit wires, a block pivoted to the base, and having a handle projecting in one direction, and an arm projecting in the opposite direction, a spring between the end of the arm projecting from the block and one end of the lever, this end of the lever having an inwardly projecting stud, and the block having a pair of outwardly projecting lugs arranged to engage the stud and hold the lever against movement until the spring has reached the desired degree of tension for properly throwing the lever.

561,588. ELECTRIC SWITCH; J. L. Hornig, St. Louis, Mo. App. filed Aug. 26, 1895. In an improved switch, a spring-actuated disc of insulating material, a conductor plate arranged in said disc in such a manner as that its ends appear on the periphery, two contacts which co-operate with said conductor plate, suitable mechanism for tripping said disc, and a float or its equivalent for operating said tripping mechanism.

561,590. ARMATURE FOR DYNAMO-ELECTRIC MACHINES; F. P. Ide, Eau Claire, Wis. App. filed April 14, 1896. In an armature of a dynamo-electric machine, the combination of a core with armature coils disposed thereon, and U-shaped retaining links adapted to secure said coils in position.

561,593. DYNAMO-ELECTRIC GENERATOR; B. G. Lamme, Pittsburg, Pa. App. filed Sept. 4, 1895. In an arc-light dynamo the combination with a separately excited field-magnet provided with regular closed circuits, of two commutators and an armature provided with two sets of coils, those of one set being respectively connected in series with those of the other through the two commutators.

561,601. REGISTER FOR TELEPHONES; E. L. Morey, Portland, Ore. App. filed Aug. 13, 1895. A register for telephones, comprising a register, an indicating strip or ribbon arranged therein, feeding devices for advancing the strip or ribbon through an opening of the casing, a shaft connected with the feeding devices, a ratchet-wheel mounted on the shaft, an oscillating lever fulcrumed on the shaft and carrying an actuating pawl for engaging the ratchet-wheel, and a bar having one end pivoted to the lever and pivoted at the other end with a fork for engaging the receiver-holding fork of a telephone.

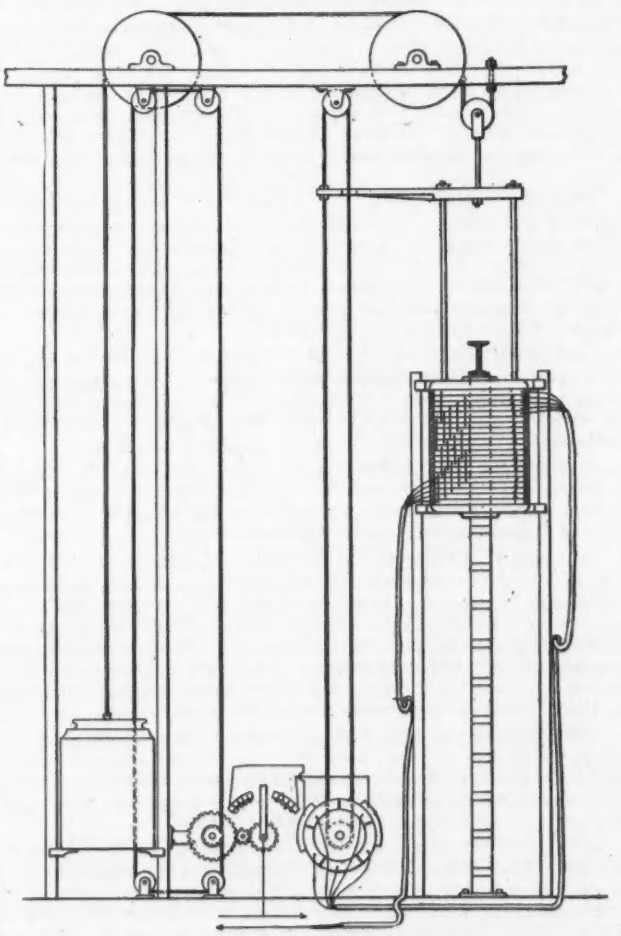
561,619. TOLL COUNTER FOR TELEPONE LINES; G. P. Seligmann-Lui, Paris, France. App. filed Aug. 18, 1894. The combination with a telephone line, of apparatus at the central station for normally preventing the passage of telephonic currents over said line, a circuit controlling device at the terminal station for operating said apparatus at the central station to thereby permit the passage of telephonic currents, and a recording instrument at the terminal station operated by said circuit-controlling device.

561,636. FORM FOR WINDING ARMATURE COILS; J. A. Weber, Lynn, Mass. App. filed Jan. 25, 1896. As a new article of manufacture, a winding form for armature coils, comprising a suitable base, means for confining the coil, and a series of terraces or grooves upon which one part of the coil is wound.

561,653. TELEGRAPH RELAY; E. Butler, New York, N. Y. App. filed June 15, 1893. In a telegraphic relay, the combination of electromagnet coils provided with cores, an armature therefor, which consists of a pivoted shaft, pole pieces adjustably secured, a T-shaped contact piece secured to the pole-pieces, a spool surrounding the armature shaft, and a solenoid wound on the spool and coils of the solenoid and of the magnets, being in the same circuit.

561,657. THERMO-ELECTRIC GENERATOR; H. B. Cox, Hartford, Conn. App. filed Feb. 13, 1895. A thermo-electric generator having a supporting-casing with a top opening to permit insertion or removal of the active element in said casing and forming a tight joint therewith, so that the casing can contain water surrounding said element.

561,698. RAIL-BOND; L. Cook, Worcester, Mass. App. filed April 11, 1896. The combination with an electric conducting wire of a sleeve enclosing the end of said wire, said sleeve being cut apart on one side and consisting of a soft and ductile metal and an outer split sleeve enclosing said soft metal sleeve, and having one end tapered or beveled.



561,828.—ELECTRIC ELEVATOR.

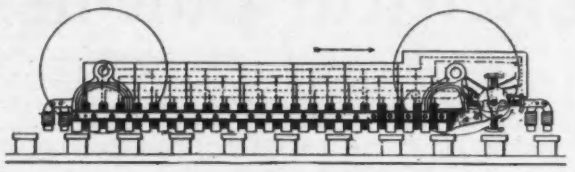
561,699. ELECTRIC MOTOR; W. H. Cooley, Brockport, N. Y. App. filed March 12, 1895. In an alternating-current machine in combination with the armature and field thereof, rectifying devices carried by such armature or field and co-operating with others carried by a third element, and means for establishing and maintaining a relative synchronous rotation between such third element and the armature or field carrying such rectifying devices.

561,700. ELECTRIC MOTOR; W. H. Cooley, Brockport, N. Y. App. filed March 12, 1895. In combination with the armature and field of an electric machine and means for producing in one of such elements rotatively-progressing magnetic poles current-directing devices constituting means for

coupling alternating currents to the windings on the other one of such elements, and thereby producing therein magnetic poles that shall for any and all rates of relative rotation between such elements remain constant in sign and bear a fixed angular relation to such rotatively-progressing magnetic poles.

561,711. ELECTRIC METER; R. O. Hood, Danvers, Mass. App. filed Jan. 26, 1895. The combination in an electric meter, of an electric motor, a magnetic damping device for regulating the speed of said motor, with a commutating device for the motor placed between its armature and the magnetic damping device.

561,735. SYSTEM OF ELECTRICAL DISTRIBUTION; C. P. Steinmetz, Lynn, Mass. App. filed Jan. 6, 1894. The combination in an alternating-current generator, of armature conductors arranged in sections angularly displaced in such manner that such sections tend individually to generate currents substantially 60 degrees apart in phase with means for converting such displaced currents into a three-phase system, suitable for operating three-phase translating devices.



561,898.—Electric Railway.

561,777. ELECTRICAL APPARATUS FOR CONTROLLING MOTION ON CRANES, ETC; J. A. Essberger and A. W. Geyer, Berlin, Germany. App. filed Sept. 29, 1894. In electrically-operated cranes or the like, having mechanisms for giving motions thereto in directions at an angle to each other, a single controlling lever movable in different directions to put into operation the different mechanisms according to the direction of movement given such lever, and two resistances controlled by said lever, and shafts carrying the contact-arms of the rheostats, the shafts being arranged at an angle to each other, and having a connection comprising rings arranged one within the other, the outer ring carrying the controlling lever.

561,803. DYNAMO-ELECTRIC MACHINE; F. G. Mayer, Chicago, Ill. App. filed Oct. 18, 1895. In a dynamo-electric machine, an outer casing and a core, metallic cylinders surrounding said outer casing and insulated therefrom, an armature adapted to revolve within said casing, and connections between said outer cylinders and said armature, whereby the circuit of the current generated in said armature is completed through said outer cylinders.

561,810. ELECTRIC BATTERY ELEMENT; G. J. Ortner, Pueblo, Col. App. filed Feb. 18, 1896. A zinc element for a battery, comprising a hub portion having a tapered opening, an amalgamated-zinc supporting-stem having a tapered portion at its lower end having a length substantially equal to the length of the opening in the element hub, and having a straight cylindrical portion above the tapered portion of a diameter equal to the smaller end of the opening through the hub.

561,821. ELECTRIC RAILWAY; W. M. Schlesinger, Philadelphia, Pa. App. filed Aug. 4, 1889. An electrical conductor composed of superposed plates of copper and iron or steel of segmental form in cross-section, in combination with traveling brushes containing with the steel or iron plate of the conductor.

561,828. ELECTRIC ELEVATOR; H. R. Smith, Chicago, Ill. App. filed March 16, 1896. In an electric elevator, a hoisting motor comprising a solenoid having a stationary core and a movable coil, said coil connected to the car-hoisting cable. (See Illustration.)

561,830. ELECTRIC RAILWAY; C. E. Stanley, Gallipolis, O. App. filed Sept. 27, 1895. The combination with the track rails, one of which has a wide groove in its head, and a narrower groove in its web communicating with that in its head, and an electric conductor seated in said narrower groove and projecting into the wider groove, of the car wheels running upon said rails and formed with grooved flanges projecting into said wider grooves and receiving the upper end of said conductor, the car-motor, and electrical connections between said wheel flange and motor.

562,838. ARC INTERRUPTER FOR STREET CAR CONTROLLERS; G. Valley, Cleveland, O. App. filed Feb. 10, 1896. An arc interrupter for street car controllers, comprising essentially an electromagnet internal to the drum, and having projections from its pole-pieces extending through the drum in proximity to the contact pieces thereof.

561,839. REVERSING AND CUT-OUT SWITCH USED IN ELECTRIC STREET CARS, ETC; G. Valley, Cleveland, O. App. filed Feb. 26, 1896. A combined reversing and cut-out switch for electric street cars, comprising in combination a moving surface having projecting therefrom a plurality of bridging contacts arranged in two sets of series, one set arranged to pass the current in the forward direction and the other to pass it in the reverse direction, and different series of each set operating to cut out one or the other motor respectively, and a series of fixed contacts arranged in the path transversed by the moving contacts and having electrical connections with the circuit in which the motors are operated.

561,846. AUTOMATIC MOTOR STOP; W. M. Wood and J. C. Miller, Elmira, N. Y. App. filed Oct. 21, 1895. In an automatic motor stop, in combination a governor, trip mechanism in position to be struck when the governor is actuated by undue speed in the motor, an electric circuit closer retained by the trip mechanism, and a stop mechanism controlled by the electric circuit.

561,847. AUTOMATIC MOTOR STOP; W. M. Wood and J. C. Miller, Elmira, N. Y. App. filed Oct. 21, 1895. In an automatic motor stop, a governor made up of the following instrumentalities: A shell or case adapted to be attached to a rotating part, a rod within the shell acted upon by a weight thrown out by centrifugal force, one end of said rod being adapted to strike the terminals of an electric circuit, and means for adjusting the distance between the terminals and the end of the rod.

561,867. ELECTRIC MOTOR AND MOTOR-GENERATOR; W. H. Cooley, Brockport, N. Y. App. filed May 21, 1895. In an electrical machine, a compound element; one of the component parts of which is located in operative relation to a second element and constituting therewith the armature and field of a motor proper, the other component part of such compound element located in operative relation to a third element and constituting therewith the armature and field of a motor-generator; electric conductors constituting a winding on one of such motor generator elements independent of any winding supplied with electric currents for producing magnetic poles in such motor-generator element, means, independent of relative rotation between such motor elements, for maintaining a relative rotation between such motor generator elements, such generative winding connected in series with the windings on one of such motor elements.

561,872. ELECTRICAL ACCUMULATOR; Gaston de Schrynmakers de Dormael, Brussels, Belgium. App. filed May 1, 1895. An electro-accumulator having negative material therein and depolarizing peroxide arranged in direct contact with the negative material.

561,878. GALVANIC BATTERY; T. E. Fogalsang, Sacramento, Cal. App. filed July 29, 1895. In an electric battery, an electrolyte consisting of two parts of sulphuric acid, one part of nitric acid, and seven parts of a solution obtained by boiling the parts of the eucalyptus tree in water.

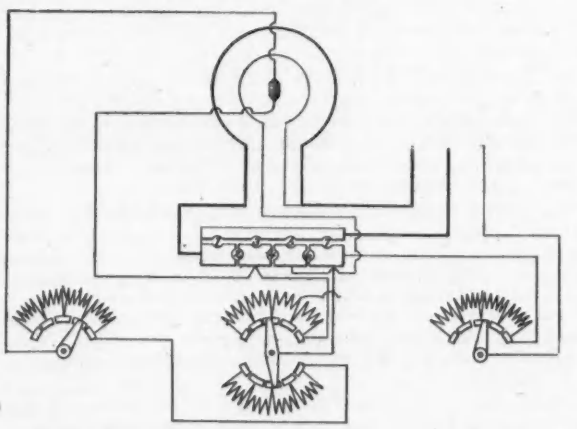
561,881. ELECTRIC CHIME; J. H. Gerry and F. M. Schmidt, Brooklyn, N. Y., App. filed March 18, 1895. In electric chimes, the combination of a set of chimes and hammers therefor, solenoids and their cores corresponding to the several hammers, the several relays having their contacts in circuit each in series with one of said solenoids and in multiple-arc with the remainder, and its magnets in series with one of a set of circuit-closing devices and means for operating said circuit-closing devices.

561,898. ELECTRIC RAILWAY; P. W. Leffler, Chicago, Ill. App. filed Aug. 12, 1895. The combination with a car or other traveling body, of magnetic devices for producing a magnetic field along the line of travel, a supply conductor electrically connected to said field at intervals along the line for dividing said field into sections having a relatively high electrical resistance as compared with the corresponding sections of said supply-conductor, and switches in said supply-conductor operated from said traveling body for breaking the circuit through said supply-conductor and causing the current to take a by-path through the adjacent field section or sections.

561,899. CONTINUOUS CURRENT RECTILINEAR MOTOR; P. W. Leffler, Chicago, Ill. App. filed Oct. 8, 1895. In a rectilinear motor, the combination with a number of polar projections or poles of alternate polarity situated along the way or line of travel, of a magnetic core mounted upon the vehicle with its axis parallel to the line of travel, said core being wound with a number of coils, the said coils being connected together end to end to form a closed circuit, a commutator with which the ends of said coils are respectively connected, and brushes bearing upon said commutator and connected with a source of electricity whereby current is directed through the coils to produce changing poles in the magnetic core, adapted to react upon the poles situated along the way, to propel the vehicle forward.

561,918. ELECTRICAL MEASURING INSTRUMENT; H. A. Rowland, Baltimore, Md. App. filed Oct. 2, 1895. The combination with a dynamometer, of a shunt box connected to the terminals of the dynamometer, and a pivoted arm making frictional contact with the base of the instrument and carrying a reading scale. (See Illustration.)

561,919. ELECTRICAL MEASURING INSTRUMENT; H. A. Rowland, Baltimore, Md. App. filed Oct. 2, 1895. The combination with an electrical measuring instrument, means for attaching the same to the wall, and a pivoted arm capable of folding against the wall and a telescope and reading scale attached to said arm.



561.918.—Electrical Measuring Instrument.

561,943. ELECTRIC SELF-WINDING CLOCK; R. A. Mitchell, Brooklyn, N. Y. App. filed Jan. 16, 1895. In a self-winding clock, the combination of a winding-electromagnet having a swinging armature, a segmental gear having a counter-balance and moving with said armature, a train of gears driven by said electromagnet through a ratchet and a pawl, a fly-wheel, and a current interrupter actuated by said clock.

561,951. ELECTRICAL CONNECTION; T. Grutting, St. Paul, Minn. App. filed Aug. 19, 1892. The combination in an electrical connection of a base or receptacle having an annular groove with gates, a contact ring therein, and a connecting screw secured in the centre and provided with an annular rib or guard.